Types of Forecast and Weather-Related Information Used among Tourism Businesses in Coastal North Carolina

by

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This study profiles the coastal tourism sector, a large and diverse consumer of climate and weather information. It is crucial to provide reliable, accurate and relevant resources for the climate and weather-sensitive portions of this stakeholder group in order to guide them in capitalizing on current climate and weather conditions and to prepare them for potential changes. An online survey of tourism business owners, managers and support specialists was conducted within the eight North Carolina oceanfront counties asking respondents about forecasts they use and for what purposes as well as why certain forecasts are not used. Respondents were also asked about their perceived dependency of their business on climate and weather as well as how valuable different forecasts are to their decision-making. Business types represented include: Agriculture, Outdoor Recreation, Accommodations, Food Services, Parks and Heritage, and Other. Weekly forecasts were the most popular forecasts with Monthly and Seasonal being the least used. MANOVA and ANOVA analyses revealed outdoor-oriented businesses (Agriculture and Outdoor Recreation) as perceiving themselves significantly more dependent on climate and weather than indoor-oriented ones (Food Services and Accommodations). Outdoor businesses also valued short-range forecasts significantly more than indoor businesses. This suggests a positive relationship between perceived climate and weather dependency and forecast value. The low perceived dependency and value of short-range forecasts of indoor businesses presents an

opportunity to create climate and weather information resources directed at how they can capitalize on positive climate and weather forecasts and how to counter negative effects with forecasted adverse conditions. The low use of long-range forecasts among all business types can be related to the low value placed on these forecasts. However, these forecasts are still important in that they are used to make more financially risky decisions such as investment decisions.

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May God bless you and keep you

May his face shine upon you and be gracious to you

May he lift his face to you and grant you peace

~Numbers 6:24-26

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1. Introduction

Since its first release of an official three-day forecast in 1901, NOAA's National Weather Service (NWS) has provided climate and weather forecasts at a variety of spatial and temporal scales (NOAA's National Weather Service 2013). During that time, the NWS has conducted consumer research to assess its products including but not limited to: the effectiveness of terminology in public forecasts and specific geographic areas (Saviers & VanBussum 1997), economic values of climate and weather forecasts (Katz & Murphy 1997), forecast use by demographic and general customer satisfaction (Claes Fornell International 2005) and how the general public receives, perceives, uses and values weather forecasts across a range of contexts (Lazo, Morss & Demuth 2009). However, there is still a need to investigate the end-user needs of specific industries including tourism. The weather and climate-sensitivity of the tourism sector parallels that of the agriculture, transportation and insurance industries. The extent of sensitivity varies among different business types as do the climate and weather information needs. In spite of the recognized sensitivity, there have been very limited evaluations of the use of climate and weather forecast information or assessments of the climate-services needs within the tourism sector. While many climate and weather information resources are applicable to the tourism community including climate change assessments, drought, snow, wild land fire management and seasonal predictions (Center for Sustainable Tourism 2013), some tourism environments have received noticeably little outreach from the global climate-monitoring network including coastal destinations (Curtis et al. 2011).

Climate and weather information is available for all types of events including precipitation, temperature, and wind forecasts for tourism actives such as kite boarding and

sailing; sea surface temperatures for fishing; and surf reports (Weather Flow Inc. 2014; Fish Weather 2014; Magic Seaweed Ltd. 2014;NWS 2013). This study focuses on the precipitation and temperature forecasts produced by NOAA with a focus on the use of different temporal forecasts. A variety of forecast types with differing lead times exist within NOAA's National Weather Service (NWS 2013) and Climate Prediction Center (CPC 2013). Short-range forecasts include, but are not limited to, hourly and daily forecast lead times, medium range forecasts include weekly forecast lead times (NWS 2013), and long-range forecasts include monthly and seasonal forecast lead times (CPC 2013). This study proposes to investigate the use of different forecast types and furthermore, addresses the decision-making processes among tourism business owners in the eight NC CAMA oceanfront counties through a statistical analysis of an online survey.

Based on our current understanding of uses of weather and climate forecasts in the tourism sector, it is hypothesized that short and medium range forecasts would be consulted more than long-range forecasts. Independent variables measured in this study include: business type (Curtis et al. 2009), business size (SBA 2013) and age of business. Dependent variables measured in this study include: forecast value (Murphy 1993), the number of ways forecasts (Klopper et al. 2006) and other weather-related tools (Roncolli et al. 2009; Weather Flow Inc. 2014; Fish Weather 2014; Magic Seaweed Ltd. 2014) are used, and business owners/managers' perceived dependency on climate and weather. Additional information attained included: the respondent's position in the company, their sources of climate and weather information, and education (Orlove et al. 2004). This study's research questions are as follows:

RQ1: What types of forecasts do tourism business owners use the most and for what purposes?
RQ2: What types of forecasts do tourism business owners use the least and why?

RQ3: What factors influence their decisions to use or not use a forecast?

RQ3a: What impact does business age have on the business owner/manager's perceived dependency on climate and weather, forecast use and perceived forecast value for each type of forecast?

RQ3b: Does the size of a business impact its perceived dependency on climate and weather, forecast use and perceived forecast value for each type of forecast?

RQ3c: Do certain types of businesses exhibit similar patterns in perceived dependency on climate and weather, forecast use and perceived forecast value for each type of forecast?

RQ4: What other tools do coastal tourism business owners use as alternatives to weather and climate forecasts?

2. Literature Review

2.1 Definitions

Weather is a summary of the atmospheric conditions at a particular time and place, while climate is a statistical description of daily weather events over a long period of time. Tourism has been defined as the experience of traveling for recreation where recreation is the voluntary engagement in activities for satisfaction and pleasure. Tourism climate research, often called tourism climatology, is broadly defined as the interactions and relationships of tourism and recreation with climate and weather. These connections have highlighted the economic value of climate to tourism destinations and have led to the suggestion of climate being a resource exploited by tourism, thus justifying the need to explore its opportunities and value to the tourism industry (Matzarakis & Freitas 2001). Therefore, it is suggested that climate and weather forecasts can be a valuable tool in creating positive relationships with a destination and in planning for the best ways to take advantage of environmental resources.

A weather forecast for the purposes of this study is defined as a description in 12-hour increments of the behavior of various weather elements including: probability and type of

precipitation, sky condition, temperature and wind (National Weather Service/NOAA, Department of Commerce 2013). A seasonal forecast for this study is defined as a "probabilistic prediction of the climate for the season" as adapted from Ziervogel and Downing (2004 p.73). The Climate Prediction Center produces forecasts with three-month lead-time known as "seasonal outlooks" (CPC 2013).

2.3 Impacts of weather and climate on tourism businesses

Weather and climate-induced factors can create long-lasting impacts on tourism dependent businesses (World Tourism Organization 2008), including the approximately 27,300 North Carolina tourism related businesses (Curtis et al. 2009). Businesses respond to weather and climate in many ways including: shortening traditional profit-making seasons, raising prices to help cover economic losses, and responding to the challenge of maintaining stable business activity (Alvord et al. 2008). Positive relationships can also be formed between weather-sensitive outdoor recreational activities and indoor activities. Seasonal climatic information can help with the planning, scheduling and promotion of alternative indoor activities when weather conditions are not conducive to outdoor activities and vice-versa (Perry 1972).

Since 1991, all eight oceanfront counties in North Carolina have experienced a general trend in increased economic impact from travel in North Carolina. Moreover, latest reports indicate all eight counties saw the greatest impact yet in 2012. Assessing the types and specific uses of tools by businesses among coastal regions such as this study area (i.e. climate and weather forecasts) is one way to identify barriers and opportunities for its continued economic success (US Travel Association 2014).

2.4 Climate and Weather-sensitive tourism businesses

Tourism end users of climate and weather information vary greatly and include Accommodation, Hotel managers, Franchises, 'Chain' operators, Restaurants, Cruise lines, Resort managers, Support and subsidiary organizations, Destination Marketing Organizations, Insurers, Retailers, Services (e.g. laundry), Business Consultants, Trainers, Research Organizations' Industry Organizations, Trade Associations, and Non-Governmental Organizations (Hale and Altalo, 2002). Other recognized potential end users include: federal, state, regional, and local governmental planning, commerce, and marketing agencies, cultural event planners, and the sporting event industry that includes events such as football, baseball, and the Olympics. Tourism businesses recognized as weather-dependent such as ski resorts and diving companies are also potential beneficiaries of climate and weather forecast information (National Climatic Data Center 2010). Coastal regions also contain distinctive end users of climate and weather information including charter fishing & boat rentals (Gamble & Leonard 2005).

2.5 Weather and climate information needs of tourism businesses

Many uses of climate and weather information have been proposed, but implementation is limited within tourism businesses. One explanation for this lack of use is that many tourism businesses are not even sure of their exact climate and weather information needs (Curtis et al. 2009). It has also been suggested that product adoption, referring to seasonal forecasts, is driven by perceived utility. Two different models can explain the adoption of a product-appropriability and contextual adaptation models. The appropriability model proposes "the utility of the product should sell itself". However, in the case of seasonal forecasting, the scientific community has

seen a shift to a contextual model approach, which proposes that a product's utility and subsequent success, is created through its relevance to end-users (Ziervogel & Downing 2004).

Tourism businesses are looking for realistic forecast information as well as strategies to effectively use this information. Centers such as The National Climatic Data Center (NCDC), North Carolina Climate Office (NCCO), Southeast Regional Climate Center (SERCC), and North Carolina Sea Grant are responding to this need by considering tourism businesses as a stakeholder in their product and thus, looking for ways to communicate weather and climate information to this stakeholder sector effectively (Robinson, 2008).

Tourism business end users' perceived utility and value of a forecast can be directly related to its accuracy (Hartmann et al. 2002).

2.6 The state of weather and seasonal forecast use among tourism businesses

Climate and weather can impact the overall experience and satisfaction of a tourist, positively and negatively. In this service-oriented industry, financial success is dependent on facilitating good experiences resulting in satisfied customers who then have a reason to patronize a business' services again. Weather and climate forecasts are tools that can be used to prevent negative experiences or market potentially good ones. A windy day might make cycling or golfing difficult. Storms halt almost all outdoor activities or in the least make them very dangerous. Adverse weather conditions can drive tourists inside looking for activities of a social or cultural nature perhaps. Knowledge of the upcoming seasonal forecast can provide planning insight in order to respond to some of the typical weather patterns. Having a strategy to deal with the many weather scenarios possible in a season could result in a better ability to keep tourists satisfied with an overall good experience in the event of bad weather. Tourism business owners

are not the only users of climate and weather information. Tourists can find value in this information as well. For instance, most resorts have tourist information centers that provide weather forecasts with lead times up to 72 hours (Martín, Gómez 2005). The use of seasonal forecasts in general has remained mostly in an agricultural risk management and decision-making context (Everingham et. al 2002). This literature would most relate to agritourism and wine tourism, which are also affected by seasonal climate variability. The changing of leaves or wine quality both depend on complex climate and weather activity ranging from a year to a day out (Curtis et. al 2009). Investigation into the perception and use of weather and seasonal forecasts into a wider range of tourism sectors has yet to be seen.

Some of the indoor tourism operations such as hotels, vacation rentals and restaurants do find value in pertinent climate and weather information (National Climatic Data Center 2010). However, it is recognized that a majority of recreational and tourism activities in coastal destinations are outdoor-oriented making climate and weather information invaluable to planning outdoor activities, their duration and the success or enjoyment of that activity (Gamble & Leonard 2005). The National Weather Service offers forecasts ranging from hourly to weekly lead times. The Climate Prediction Center- a branch of the National Weather Service- offers many types of climate information such as climate variability predictions, real-time monitoring of climate and assessments of the origins of major climate anomalies. Predictions span a time scale of a week to seasons and extend as far as technically feasible into the future. Three-month outlooks also known as Seasonal Outlooks, predict variability in regards to seasonal averages for precipitation and temperature (National Weather Service 2008). Climate and weather dependent businesses could make advantageous operational decisions using seasonal outlooks such as resort renovations or commencement of snowmaking at ski resorts. Forecasting probabilities for

weather phenomena such as precipitation and temperature can help with interpretation of hazardous conditions and be used for operational decisions.

Weather and climate can be viewed as a resource to be exploited and used for a competitive edge. Preferable weather and climate conditions can provide tourism-marketing materials. Costs related to heat and air-conditioning are considered in development and renovation investment decisions. Knowledge of an upcoming summer season with above normal temperatures for example, could compel tourism businesses to invest in destination renovations that include more energy efficient air conditioning units. Resort design and landscaping could respond to weather and climate data. Rain gardens could be constructed to help absorb excess water from an unusual rainy season as well as providing aesthetically pleasing aspects to a destination. Predicting profit returns or cash flow is pertinent for forecasting the degree of financial stability a business will face in the future. Seasonal and weekly weather information can aid in these predictions. A beach-side restaurant knowing that there will be above normal summer precipitation can prepare for a possible sales decrease, consequently reducing staff to mirror this sales decrease (Matzarakis & Freitas 2001).

Although there are many suggested uses of climate and weather information among tourism businesses, a disconnect still exists between the information and end-users. An adaptation of the explanations offered by Ziervogel and Downing (2004) for hindrances of seasonal forecast awareness and uptake could prove applicable to tourism business owners as well. Ziervogel and Downing suggest that forecast interpretation, relevance to the destination and knowledge of seasonal forecasts could attribute to a lack of seasonal forecast use. A poor understanding of forecasts could be due to the use of technical language by the scientific community that is expected to be understood by the general public. The broad geographical

context in which seasonal forecasts are delivered could prove inappropriate for tourism business owners planning for a specific location. Lastly, potential users may not even know about seasonal forecasts, where to get them or how they may be used (Ziervogel & Downing 2004).

2.7 Alternate sources of climate and weather information

The cultural contexts from which end-users' perceptions and knowledge frameworks come from can greatly shape the way they ascribe meaning and value to what they see and know. In communities particularly sensitive to changes in nature, specifically climate and weather, the sole dependence on climate and weather forecasts is seen as a fallacy (Roncolli et al. 2009). These communities often rely on wind, flora and fauna as forecast indicators. However, in areas where these indicators' reliability is eroding due to climate change, the need for scientific forecast information is increasing. The perceived objectivity of scientific information has been described as a basic societal value and influences the acceptance and implementation of scientific information (Strauss 2003). Other factors not related to climate variation such as price fluctuations, violent attacks, legal prosecution and social marginalization can influence a tourism business owner's decision making. All of these human dimensions should be considered in understanding the use or lack thereof in climate and weather information among tourism businesses located in particularly weather-sensitive communities such as coastal destinations (Roncolli et al. 2009).

3. Methods

3.1 Area of study

Survey respondents were selected from the eight North Carolina (NC) oceanfront counties. These counties were chosen because they comprise the vast majority of tourism businesses in the twenty NC Coastal Area Management Act (CAMA) counties. They include: Brunswick, New Hanover, Pender, Onslow, Carteret, Pamlico, Dare and Currituck counties (Figure 1).

Figure 1: The eight North Carolina coastal counties study area (North Carolina Department of Cultural Resources 2013)

3.2 Sample

A list of 3,391 tourism businesses in the twenty NC CAMA counties was obtained from the Center for Sustainable Tourism at East Carolina University. The counties were then filtered to display tourism businesses in the eight NC oceanfront counties. The database contained information about each business including: business name, person of contact, their position in the company, contact information and US Census Bureau North American Industry Classification

System (NAICS) code. The following coastal tourism businesses sectors were identified as climate and weather dependent: accommodations, restaurants and bars, transportation, retail, outdoor activities, state parks, charter fishing, boat rentals and ecotourism (Curtis et al. 2009, Gamble & Leonard 2005) all of which have corresponding NAICS codes. Because of the wide variety of businesses discovered in the area though, more general categories were needed to accommodate businesses that would experience climate and weather dependency but may not fit these categories. These general categories were adapted from a study by Roehl (1998, p.63) and grouped into the following categories:

- Performing Arts, Spectator Sports and Related Industries
- Museums, Historical Sites, and Similar Institutions
- Amusement, Gambling, and Recreation Industries
- Accommodation
- Food Services and Drinking Places

The counties were filtered again to only display climate and weather dependent businesses. Initial descriptive statistics deemed some sizes of these categories too small for analysis, therefore existing categories were restructured and new ones created. According to NAICS codes, Agriculture, Forestry, Fishing and Hunting are underneath one category. Therefore, original responses for Fishing, Hunting and Trapping were grouped with crop production into an Agriculture category. Establishments in this sector can include: farms, ranches, nurseries, orchards or hatcheries (Bureau of Labor Statistics 2014). While charter boat fishermen are seen as tour operators in a tourism context, in an agricultural context, they could be seen as hunters and trappers or even farmers of a product should they participate in cultivation in nurseries and hatcheries for livestock such as oyster beds. Outdoor Recreation was created by combining

original categories of recreational activities that are primarily outdoor-oriented: Amusement and Recreation; RV Parks and Recreational Camps; Spectator Sports; Diving; Scenic and Sightseeing; Transportation. Accommodations only saw an addition of travel arrangements and reservations to its category. Park and Heritage was a newly created category that included state park facilities and governmental funded organizations. The Other business sector included mainly store retailers and event planning. Food services remained the same. The following business types emerged:

- Agriculture (i.e. charter boats, a pier)
- Outdoor Recreation (i.e. golf clubs, campgrounds)
- Accommodations (i.e. cottages, inns)
- Food Services (i.e. chain and local restaurants, grills)
- Parks and Heritage (i.e. historical gardens, state parks)
- Other (i.e. bookstore, event planning)

3.3 Sampling Procedure

North Carolina Chamber of Commerce (COC) websites were visited to verify their business directories with the database. Each business not found in a COC business directory was Google searched to verify its existence. Each business website was visited to verify their contact information in the database. Businesses were sent a message (Appendix B) containing information about the study and the survey link though email, contact forms on websites and Facebook. A total of 1,089 businesses were contacted with 186 businesses taking the survey. Completed surveys amounted to 177 yielding a response rate of 16.3%.

3.4 Survey Design

The survey (Appendix C) possessed a variety of question types including: multiple choice, single choice, graphics and open-ended questions. A flow-logic was installed to direct respondents to certain lines of questions based on their indicated types and frequency of forecasts used.

A pilot test list was created through an existing recipient list of a climate and weather related product created out of the Center for Sustainable Tourism at East Carolina University. Pilot test participants were NC tourism business owners/managers located outside of the study area. Upon completion, respondents were asked about the quality of survey questions, question answer choices, length of the survey and general comments they may have. Pilot survey suggestions were considered and subsequent survey changes were made.

3.5 Survey Administration

The survey was administered online through Qualtrics and took an average of 8 minutes to complete. Survey respondents were not allowed to answer questions twice and were forced to respond to every question in order to move forward in the survey. Respondents were able to close out the survey and return to complete it as many times as needed. At the end of the survey, respondents were thanked for their time and given contact information for follow-up opportunities.

3.6 Measurements

Independent variables measured in this study include: business type (Curtis et al. 2009), business size (SBA 2013) and age of business. Dependent variables measured in this study

include: forecast value (Murphy 1993), the different ways forecasts (Klopper et al. 2006) and other weather-related tools (Roncolli et al. 2009) are used, and business owners/managers' perceived dependency on climate and weather. Frequencies were also examined for the respondent's position in the company, their sources of climate and weather information, and education. Business type options within the survey are determined according to the North American Industry Classification System (NAICS) and a study conducted by Roehl (1998, p.63). The NAICS is a business classification system used by federal statistical agencies to collect, analyze, and publish statistical data related to the U.S. business economy (U.S. Census Bureau 2013). Business type options include: crop production; breweries and wineries; fishing, hunting and trapping; amusement and recreation; RV parks and recreational camps; spectator sports; scenic and sightseeing transportation; store retailer; travel arrangements and reservations; accommodations; food services and bars and "Other" with an option to write in their other choice. Descriptive statistics revealed some of the original categories were not represented such as wineries and breweries while other categories only had two or three businesses representing them. Also, examination of forty-five text responses resulted in eighteen responses that did not easily fit underneath existing business type categories. Therefore, the following new categories were created or existing categories restructured: Agriculture (n = 23); Outdoor Recreation (n = 33); Accommodations (n = 41); Food Services (n = 53); Parks and Heritage (n = 14); Other (n = 13).

Respondents were asked in an open-ended question how many employees the company has. Responses were converted to numerical values using a variety of methods. If the number of employees was given as a range such as "8-10", then the average value of that range was entered. Some respondents differentiated between staff sizes in the on-season and the off-season. On-

season staff sizes were used because they contribute the most to the total yearly revenue of the business. Some respondents specified the number of part-time and full-time employees. The sum of both values was entered. If a number with a plus sign ("+") or an approximate value such as "50+" or "approximately 15 years" was given, the number plus one was entered (51 or 16). Volunteers were not counted as employees. One respondent entered "none" because they are family owned. However, even if the owner/s do not count themselves as an employee, their family-owned distinction led to an assumption that at least two people from the family run the business. The average U.S. family size of 2.58 according to the U.S. Census Bureau (2010) was rounded up to 3 and entered. Rounding up accounted for the likelihood of a child of the owner/s working in the family business and eventually taking it over. The numerical responses were grouped in accordance with the business size standards of the United States Small Business Administration. In the US a micro business has 1-6 employees, a small business has less than 250 employees, a medium sized business has less than 500 employees, a large business has less than 1000 and an enterprise has greater than 1000 employees. However, only two respondents were identified as a medium business and three as an enterprise. Thus, they were added to the category of "small business" (7-1600 employees) to ensure the sample size for each level was robust. The SBA prefers to use receipts to measure business size for industries with a high-proportion of part-time or seasonal employment (such as tourism) because it "measures the value of output of a business and can be easily verified by business tax returns and financial records" (SBA 2013). However, these records would have been nearly impossible to collect in the given time frame for data collection for the 1089 potential respondents contacted. Therefore, number of employees seemed a justifiable measure for business size.

In an open-ended question, respondents were asked to enter the age of their business. If a specific year was given, then the value was subtracted from 2014 and entered. Months were converted to a percentage of a year. If a respondent differentiated between their number of years in that business and their total years in that profession, the number of years in the profession was used because their experiences in that profession will most likely impact the policies and planning within the company. If a number with a plus sign ("+") or an approximate value such as "50+" or "approximately 15 years" was given, the number plus one was entered (51 or 16). Qualtrics did not force five respondents to answer this question. Because these missing values were random, the mean of non-missing scores was substituted for missing data (Thompson 2006, p.50). The following four business age categories were subsequently created: Infant (0-2 years), Adolescent (3-4 years), Middle-Aged (5-24 years), and Old (25 + years) (Robb 2002, p. 47) While Robb (2002) identified infant as 1-2 years old, we included zero since some businesses were less than a year old. However, only five respondents were identified as infant and eleven as adolescent. In response, a larger category of "Young" (0-4 years) was created.

Value is measured by the ability of a tool, in this case climate and weather forecasts, to help a business make financially beneficial decisions for their company. Value was measured two different ways. First, respondents were asked to rate the forecast types that they indicated they use individually in likert-scale from one to five with one being the least valuable, thus giving the respondents a scored value for each type of temporal scale forecast used. The value for each type of forecast was used within the MANOVA analysis. Second, respondents were asked to rank the five forecast types against each other based on each forecast type's realized or potential value in a likert-scale from one to five with one being the least valuable. Frequencies were reported for this measure of value. Besides asking the reason for non-use of a forecast, the

flow logic of the survey only directed respondents to questions relating to forecasts they used resulting in missing value scores of unused forecasts. Therefore, the lowest value of 1 was assigned to missing value scores since this is the most likely value the respondent would have given to the unused forecasts if asked.

Respondents were asked what temporal forecast scale they used. An image for each type of forecast was provided including: an Hourly forecast on a smartphone, a Daily forecast from weatherchannel.com, a Weekly forecast from a local TV news station weather report, a Monthly forecast from NOAA's monthly outlooks, and a Seasonal forecast from an independent source (Appendix C). For each forecast a respondent indicated that they used in the beginning of the survey, they were asked to check all the following ways they used that type of forecast: Operational Decision-Making, Risk Assessment, Marketing, Investment Decisions, Sustainability Practices, Landscaping and Finance and Budgeting (Klopper et al. 2006). The following examples were given to respondents as how these uses are implemented: Operational Decision-Making, such as staffing; Risk Assessment, such as staff and customer safety; Marketing, such as promoting attractive or appealing climate; Investment Decisions, such as buying new property or equipment; Sustainability Practices, such as energy conservation; Landscaping, such as deciding what types of vegetation to plant around your business; Finance and Budgeting, such as predicting profit returns or cash flow (Appendix C). A respondent could select up to seven uses of a forecast with the total number of uses resulting in a "usefulness" score for each forecast, which was used in the comparison analyses. Frequencies were reported for each way a forecast was used.

Respondents were asked to indicate their perceived dependency of their business on climate and weather on a likert-scale from one to five with the following values: one being not

dependent, two being somewhat dependent, three being not sure, four being dependent, and five being very dependent.

Education level of end-user was measured with the following options: less than high school, high school or GED, 2-year college/ technical school, some college but not degree, 4-year college and post graduate.

In an open-ended question, respondents were asked their position in the company. Three main category types were extracted from the text including “Owner”, “Manager” and “Support Specialist”. Responses comprising the Owner category included: owner, captain, CEO, CFO, co-owner partner, president and V.P. Responses comprising the Manager category included: manager coordinator, director, dock master, and superintendent. Responses comprising the Support Specialist category included: accounting assistant, support specialist, innkeeper, reservationist, and sales person.

4. Results

4.1 Recruitment

Potential respondents were contacted a total of five times to take the survey the second week of each month if they had not taken or finished the survey. Contact dates include: September 2013, October 2013, November 2013, January 2014, and a couple of days before the survey closed at the end of January. Due to the vacation patterns of business owners and managers in the area as well as the winter holidays, respondents were not contacted in December.

4.2 Analysis

4.2.1 Descriptives

Respondent Position

Respondents were represented by the following three categories: 55% Owners, 40% Managers and 5% Support Specialists (*M* = 1.5). Business owners were the most common type of respondent (Figure 2).

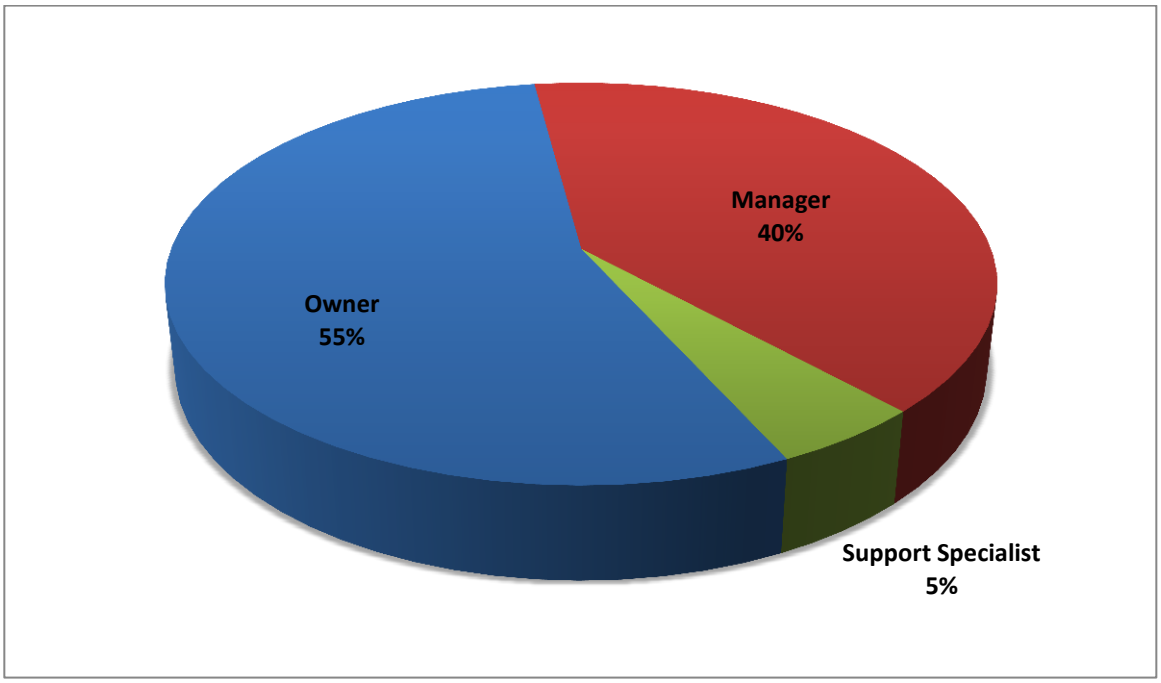

Figure 2: Position of all respondents in their represented business

Education Level

Represented education levels of the respondents included: High school/GED 7%, 2-Year College/Technical School 13%, Some College 20%, 4-Year College 44%, and Post Graduate 16% (*M* = 4.49). A four-year degree was the most common level of education attained by respondents (Figure 3).

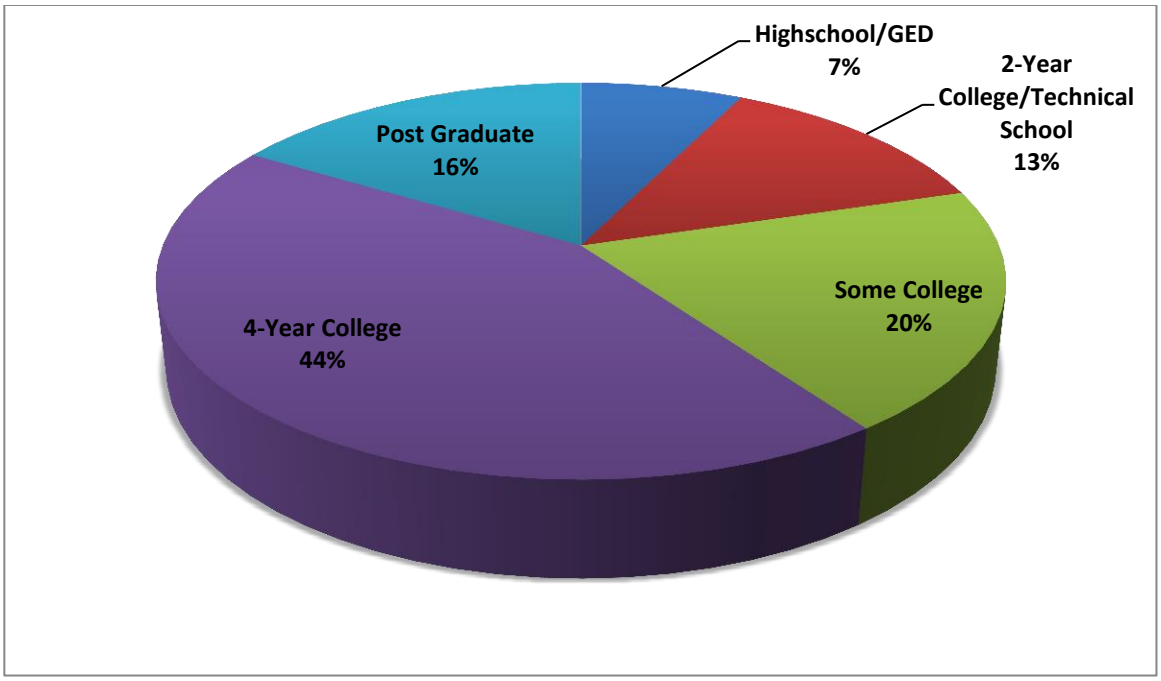

Figure 3: Education Level of all respondents

Business Type

Business types represented in the sample included: Agriculture 13%, Outdoor Recreation 19%, Accommodations 23%, Food Services 30%, Parks and Heritage 8%, and Other 7% (M = 3.23). The most common respondent was from a Food Service business (Figure 4).

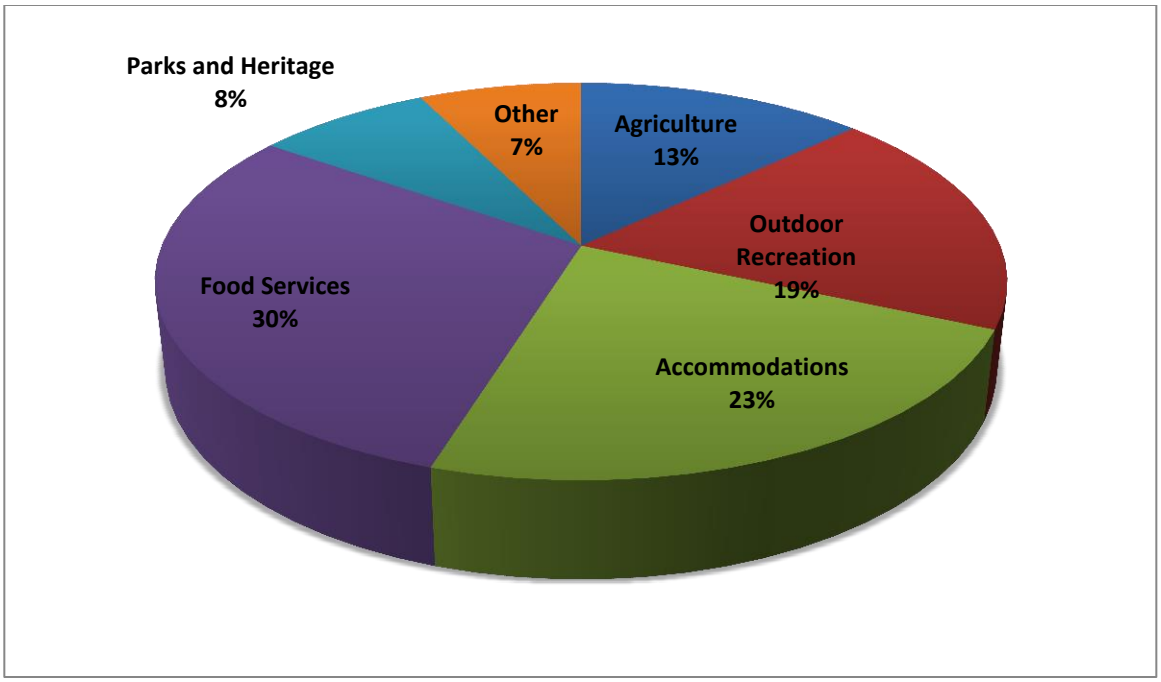

Figure 4: Business Types represented by all respondents

Business Size

Business sizes represented in the sample included: Microbusiness 18% and Small Business 82% (*M* = 1.82) A majority of respondents represented a Small Business (Figure 5).

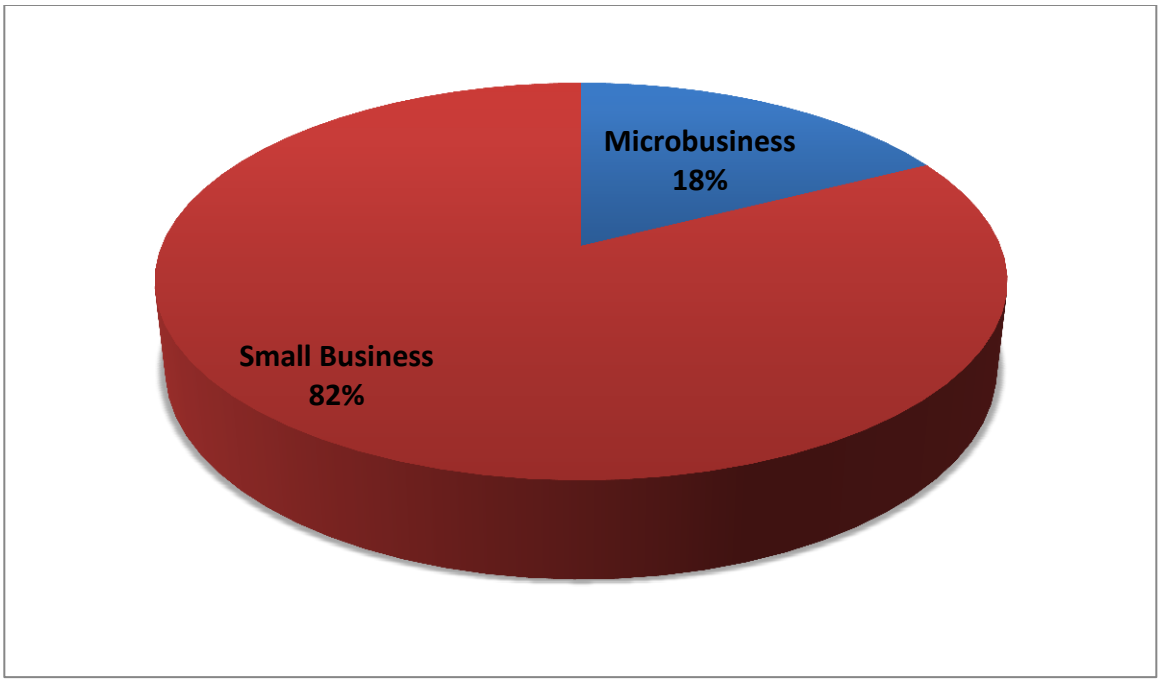

Figure 5: Business Sizes represented by all respondents

Business Age

Business ages represented in the sample included: Young 18%, Middle-Aged 12% and Old 70% (*M* = 2.25). Most respondents represented an old business (Figure 6).

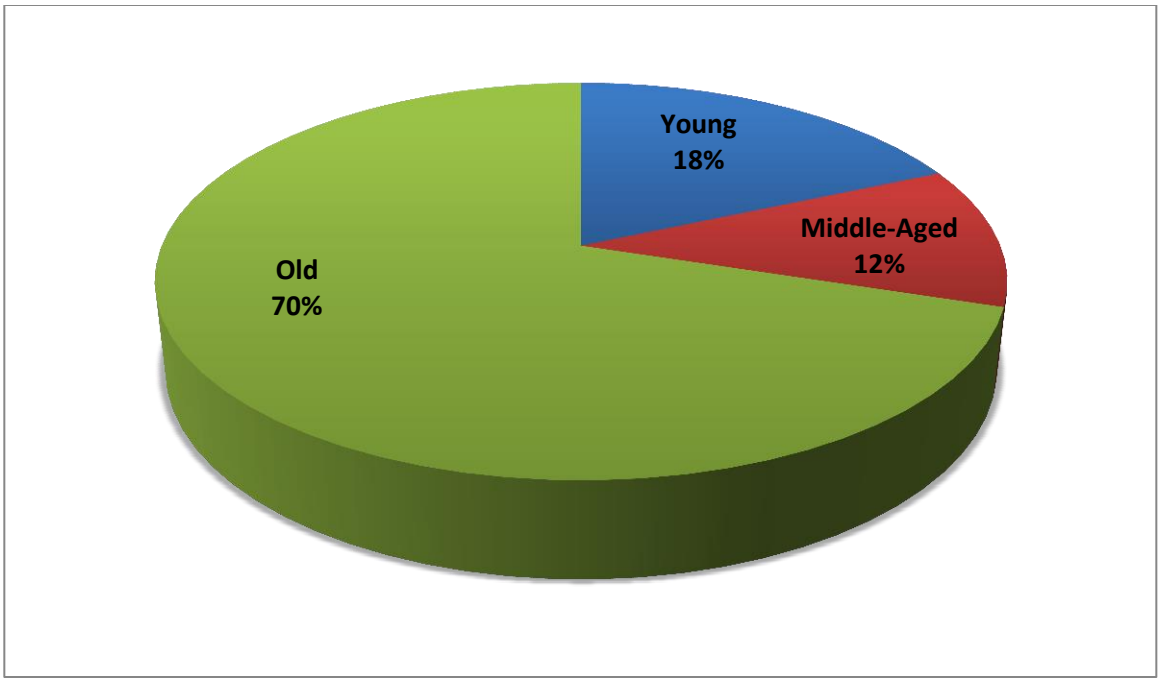

Figure 6: Business Age represented by all respondents

Perceived Dependency on Climate and Weather

Respondents' perceived dependency on climate and weather is represented in the following responses: Not Dependent 6%, Somewhat Dependent 35%, Not Sure 1%, Dependent 21%, Very Dependent 38% (M = 3.52). The average respondent indicated their business as somewhat to very dependent on climate and weather (Figure 7).

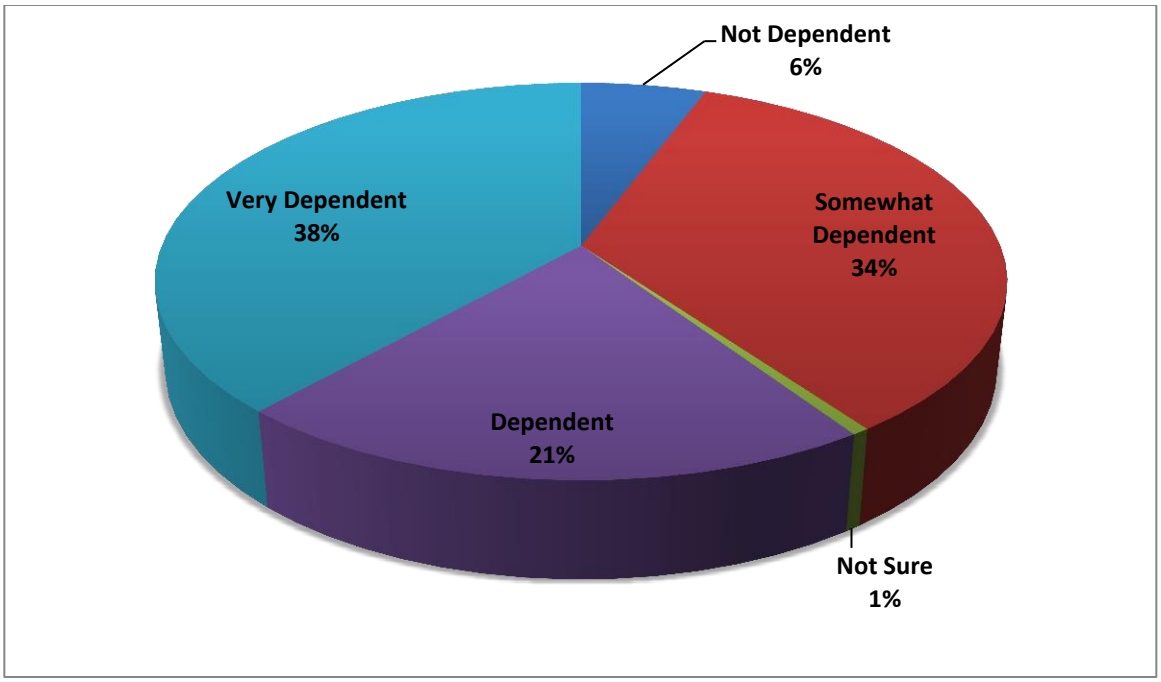

Figure 7: Perceived Climate and Weather Dependency of all respondents

How do Respondents Access Their Climate and Weather Information?

Respondents were asked how they accessed their forecast information. The following frequencies indicate individual use: Smart Phone 34%, Website 45%, Local New Station 46%, and Other 13% (Figure 8). Percentages sum to over 100% as many respondents accessed information in multiple ways. Fifty-three percent of respondents indicated the National Weather Service as their primary source of information.

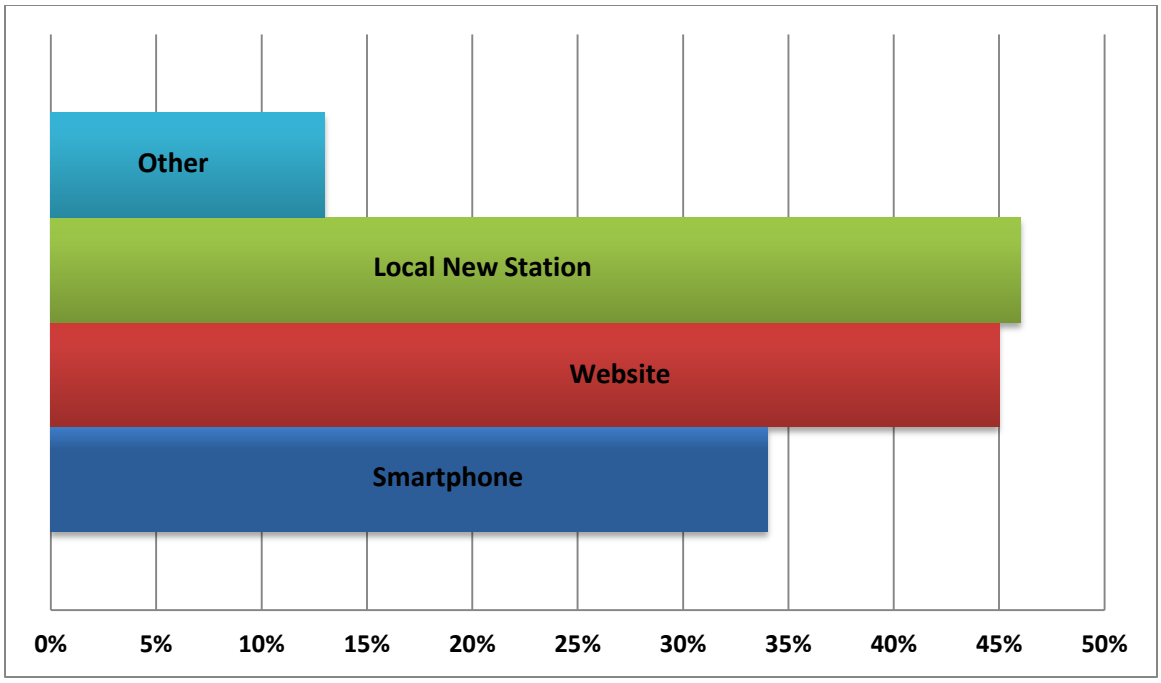

Figure 8: Respondents' indicated ways to access of climate and weather information

The total number of ways climate and weather information is accessed was then calculated for each respondent: None 4%, One Source 52%, Two Sources 15%, Three Sources 15%, Four Sources 14% (Figure 9). The average respondent accessed climate and weather information one way, but 45% sought multiple ways to access the forecast. The climate and weather information usage was slightly positively skewed .768 (SE = .183) with a kurtosis of -.606 (SE = .363).

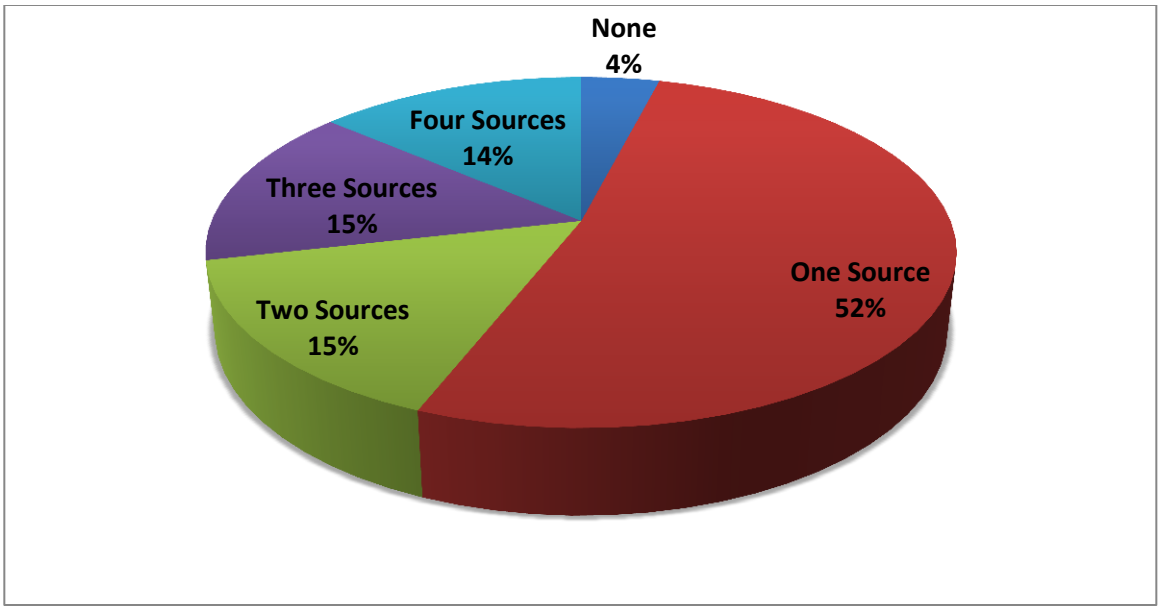

Figure 9: The total number of ways climate and weather information was accessed by all respondents

Open-ended responses for other sources of climate and weather information were examined for differences from the given categories. Displayed in Table 1, respondents gave specific websites, forms of local news and a couple of unique comments.

Internet Sources	Local News Sources	Unique Comments
Wunderground.com FryingPanTower.com Reefcast.com Weather.com AccuWeather.com NWS.gov	Local radio stations Chamber-of-commerce emails Island word-of-mouth!	"I stick my head out the window." "Combination of several local and national resources. NOT weather channel"

Table 1: Open-ended responses for Other sources of climate and weather information

What temporal scale of Climate and Weather Forecasts do Respondents Use?

Respondents were asked to select all temporal scales of climate and weather forecasts they used. The following frequencies indicate individual forecast use: Don't Use 3%, Hourly 52%, Daily 64%, Weekly 70%, Monthly 14%, Seasonal 12% and Other 9% (Figure 10). Total percentage exceeds 100%, as many respondents use multiple forecasts.

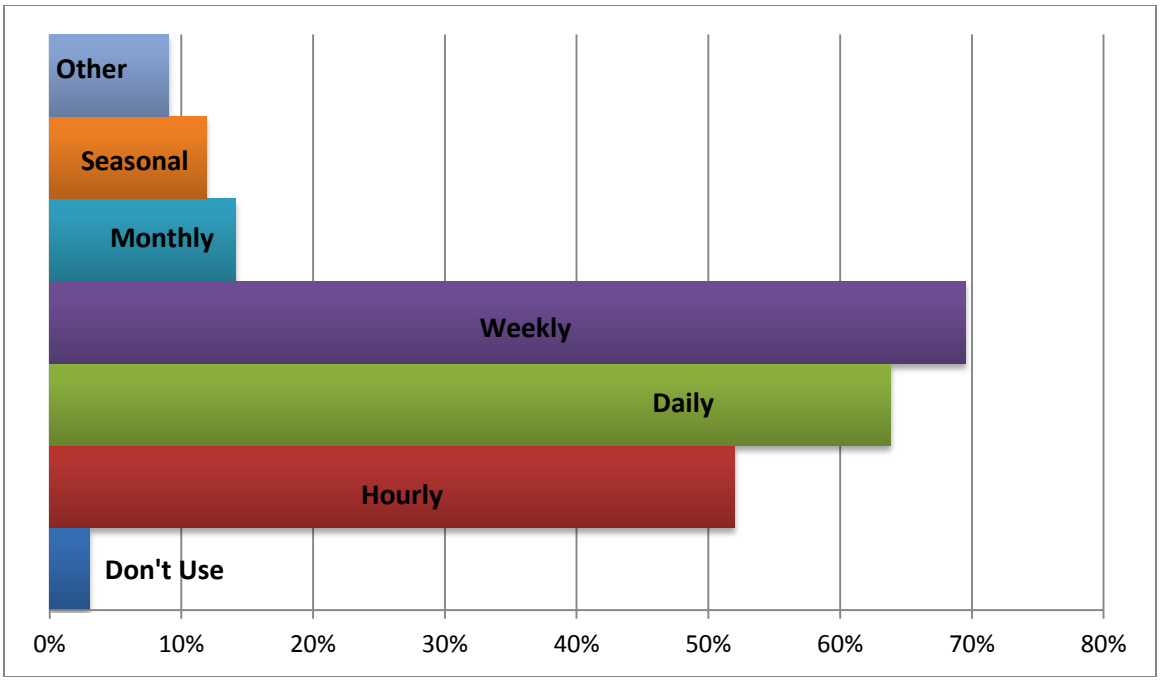

Figure 10: Frequency of individual use of each forecast

If all forecast temporal scales are considered together, the following pie chart indicates the relative frequency of each one used: Zero 7%, One 31%, Two 15%, Three 34%, Four 9%, Five 2% and Six 2%. On average, respondents use one or three temporal scales of forecasts (Figure 11) in equal numbers.

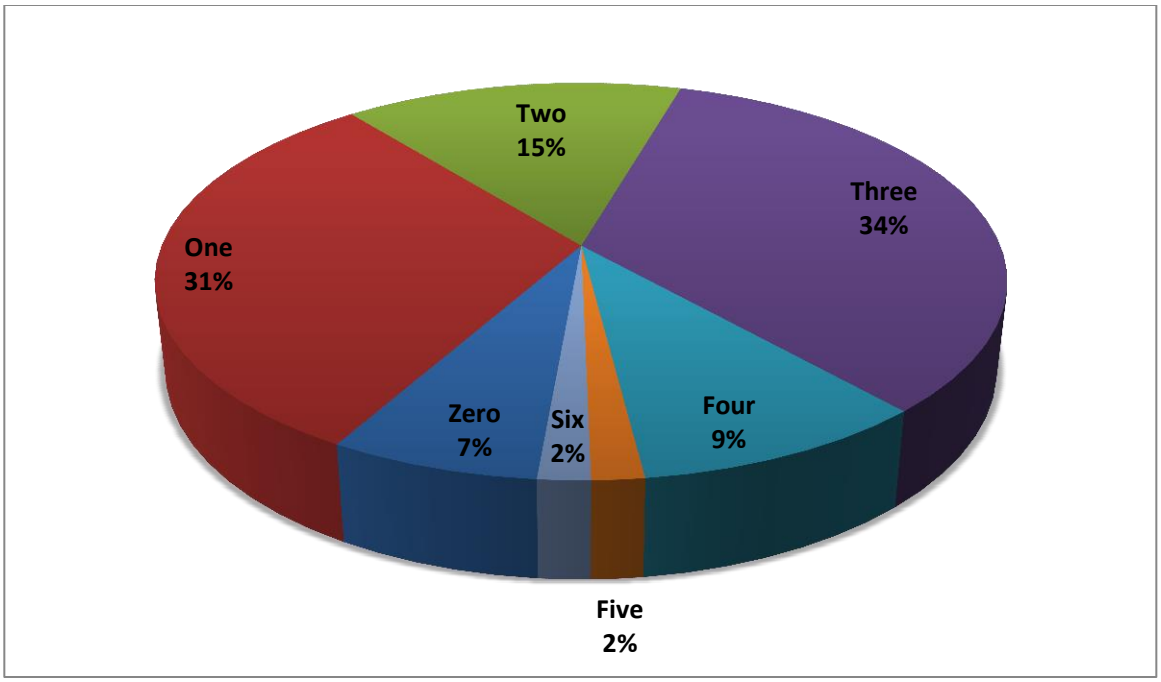

Figure 11: Frequency of total number of forecast temporal scales used by a given respondent

Open-ended responses for other ”unofficial” forecasts were examined for differences from the given categories. Displayed in Table 2 are a wide range of other climate and weather forecasts that some respondents specified using.

Other Types of Forecasts
Wunderground.com
Offshore Wx Reports
Hurricane Forecasts (3 respondents)
Radar
Weather in Motion
Marine Weather Forecast
"Use all depending on the tides, road conditions, ferry wind limits and if in busy part of the season"
"We look at the size of our beach before storms to decide if we need to bring in sand, since the nourishment we have not done this. We compare the size of the beach and the sand blowing to hourly weather forecast to add sand fence when needed."

Table 2: Open-ended responses for Other types of forecasts

Ways Forecasts Are Used

Respondents were asked to check all the different ways in which they use each temporal scale of forecast. Then the number of uses per total respondents was computed as a percentage. Percentages do not necessarily sum to 100, because some businesses do not use a particular forecast and other businesses may select multiple uses. Hourly forecasts were used in the following ways by respondents: Operational Decision-Making 30%, Risk Management 29%,

Marketing 12%, Investment Decisions 2%, Sustainability Practices 1%, Landscaping 3%, and Finance and Budgeting 8% (Figure 12).

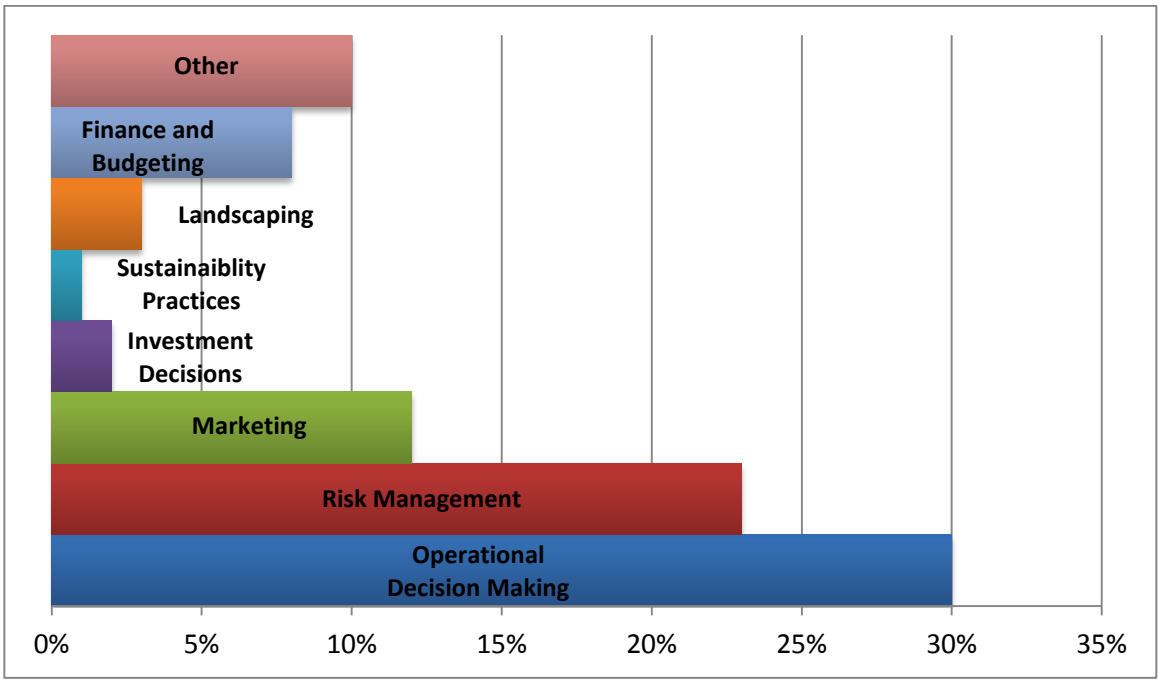

Figure 12: Frequency of individual responses of ways hourly forecasts are used

Figure 13 compares the different hourly forecast uses to each other. Operational Decision-Making and Risk Management were almost equally popular ways to use Hourly Forecasts. Other uses were not as popular: Marketing 13%, Other 10%, Finance and Budgeting 8%, Landscaping 3%. Sustainability Practices (1%) was the least popular use of hourly forecasts.

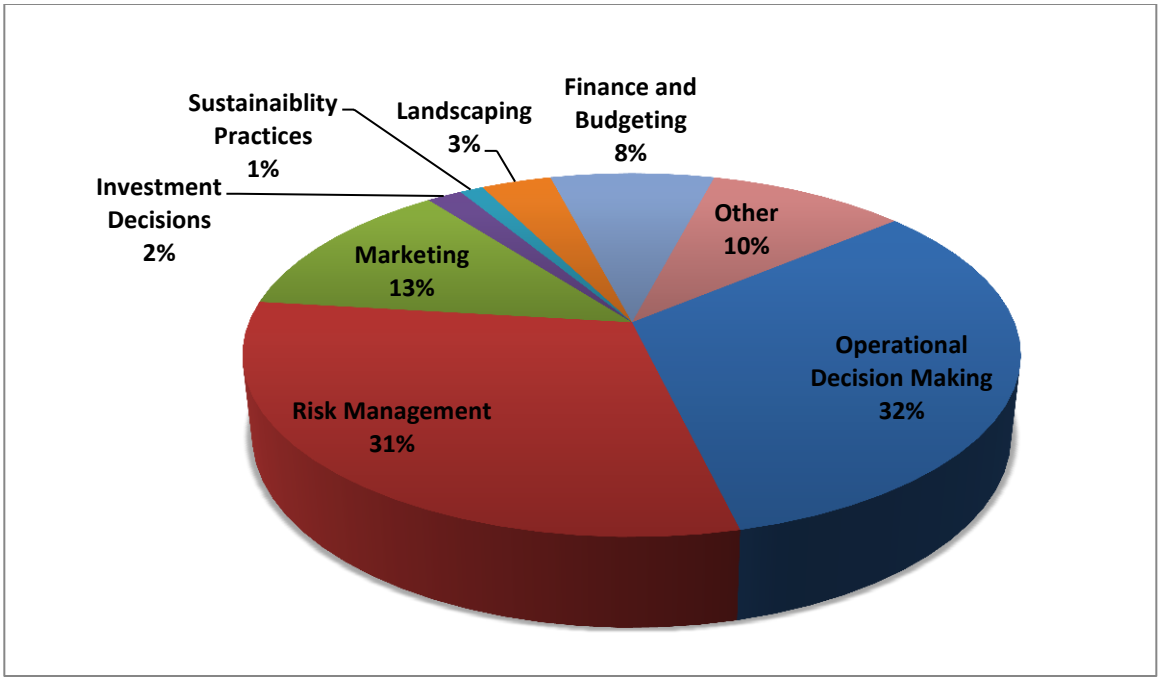

Figure 13: Comparison of different Hourly forecast uses to each other

Open-ended responses for hourly forecast use were examined for differences from the given categories. Displayed in Table 3 are respondents' specified uses.

Other Ways Hourly Forecasts are Used
"Go or no go for charter"
"Inventory control"
"Golf is an outdoor game. I keep golfers advised of weather conditions."
"Whether to keep employees on the job site or not"
"Showing properties"
"Logistics such as windstorms coming up and needing to pull pool umbrellas, etc."

“Guest questions”
“If a bad storm is coming, we need to take care of items outside of our business (ie: patio furniture, rocking chairs, etc.)”
Outdoor Event Planning (5 respondents)
“Whether or not to set up outdoor displays”
“To set up wedding on beach or inside”

Table 3: Open-ended responses for other Hourly forecast uses

Table 4 shows the number of respondents who chose a specific use of Hourly Forecasts by Business Type. Percentages for each use of Hourly forecasts by Business Type is created by taking each use of hourly forecasts by Business Type out of the total uses of a given forecast for each business type. For example, five Agriculture respondents (or 24%) used Operational Decision-Making out of twenty-one total selected uses of Hourly forecasts by Agriculture. Highlighted are the high users of a specific use of Hourly forecasts.

	Operational Decision-Making	Risk Management	Marketing	Investment Decisions	Sustainability	Landscaping	Finance and Budgeting	Other	Total Usage Score by Business Type
Agriculture	24%	43%	9%	0%	0%	0%	14%	14%	**21**
Outdoor Recreation	34%	36%	11%	2%	2%	2%	9%	4%	**47**
Accommodations	15%	30%	22%	4%	0%	7%	7%	15%	**27**
Food Services	46%	20%	14%	2%	2%	4%	10%	2%	**50**
Parks and Heritage	29%	29%	12%	0%	0%	6%	6%	18%	**17**
Other	27%	37%	0%	0%	0%	0%	0%	36%	**11**
Total Times for a Specific Use	**56**	**53**	**22**	**3**	**2**	**6**	**14**	**17**	

Table 4: Specific uses of Hourly forecasts by Business Type

Daily forecasts were used in the following ways by respondents and is displayed in Figure 14: Operational Decision-Making 42%, Risk Management 36%, Marketing 13%, Investment Decisions 2%, Sustainability Practices 2%, Landscaping 4%, Finance and Budgeting 12%, Other 10%.

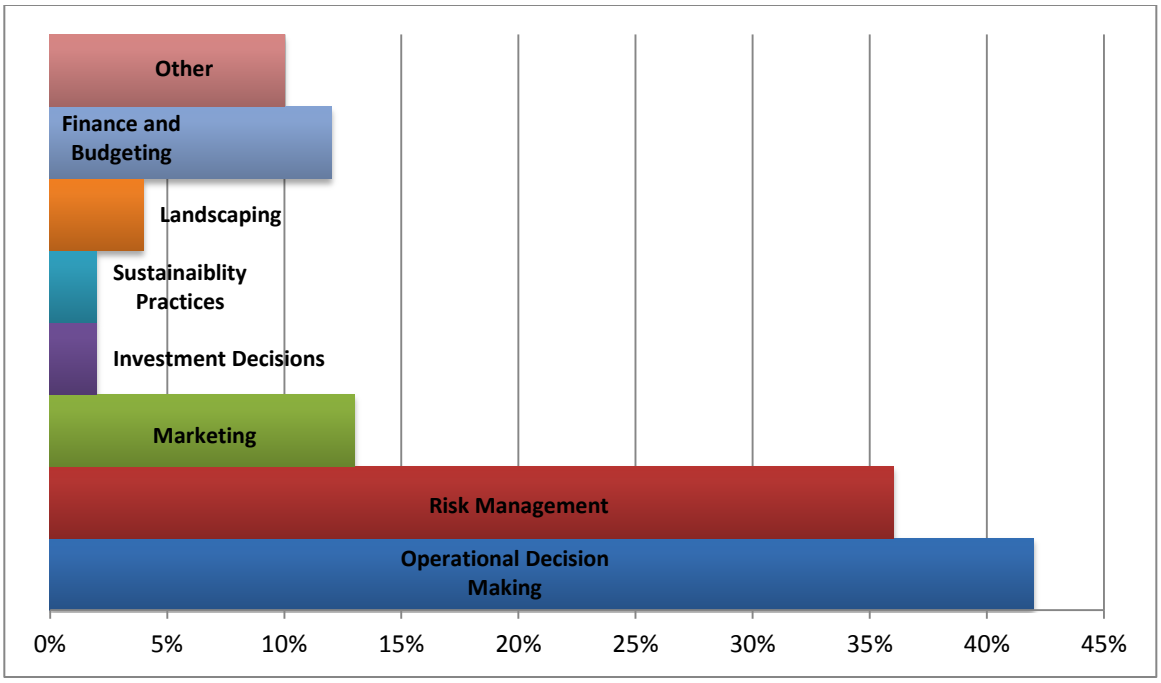

Figure 14: Frequency of individual responses of ways Daily forecasts are used

Figure 15 compares the different daily forecast uses to each other. Operational Decision-Making was the most frequent use of daily forecast with Risk Management following close behind. Marketing and Finance, Budgeting, and Other were almost equally popular uses of daily forecasts. Daily forecasts were rarely used to make decisions about Landscaping, Sustainability Practices and Investment Decisions

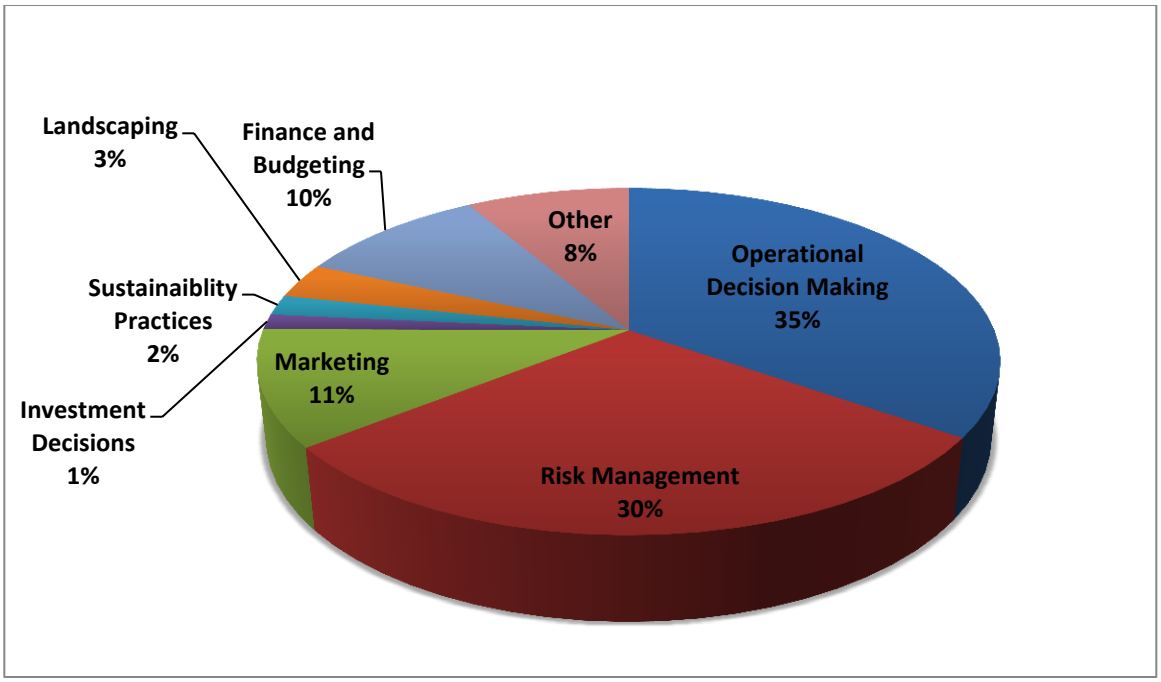

Figure 15: Comparison of different Daily forecasts uses to each other

Open-ended responses for daily forecast use were examined for differences from the given categories. Displayed in Table 5 are respondents' specified uses.

Other Ways Daily Forecasts are Used
Special Event Cancellation Notices, or determine late/early start/end times (3 respondents)
"Scheduling out of building procedures"
"Used when conversing with potential and current vacation renters"
"Whether to work or not- outside construction"

“Number of walk-ins”
“people eat rain or shine”
“Menu choices, quantity of prep”
“Outside dining”
“Outdoor entertainment”
“State Park”
“Educational programs / field trips”
“Whether or not to set up outdoor displays”

Table 5: Open-ended responses for other Daily forecast uses

Table 6 shows the number of respondents who chose a specific use of Daily forecasts by Business Type. Percentages for each use of Daily forecasts by Business Type are created by taking each use of Daily forecasts by Business Type out of the total uses of a given forecast for each business type. Highlighted are the high users of a specific use of Daily forecasts.

	Operational Decision-Making	Risk Management	Marketing	Investment Decisions	Sustainability	Landscaping	Finance and Budgeting	Other	Total Usage Score by Business Type
Agriculture	39%	39%	5%	2%	0%	5%	5%	5%	**41**
Outdoor Recreation	34%	34%	10%	2%	4%	2%	14%	0%	**50**
Accommodations	25%	28%	19%	0%	0%	6%	11%	11%	**36**
Food Services	40%	23%	10%	2%	2%	2%	12%	9%	**57**
Parks and Heritage	32%	26%	11%	0%	5%	5%	0%	21%	**19**

Other	30%	20%	10%	0%	0%	0%	10%	30%	**10**
Total Times for a Specific Uses	**74**	**63**	**23**	**3**	**4**	**7**	**21**	**18**	

Table 6: Specific uses of Daily forecasts by Business Type

Weekly forecasts were used in the following ways by respondents: Operational Decision-Making 46%, Risk Management 34%, Marketing 22%, Investment Decisions 4%, Sustainability Practices 3%, Landscaping 5%, Finance and Budgeting 17%, Other 11% (Figure 16).

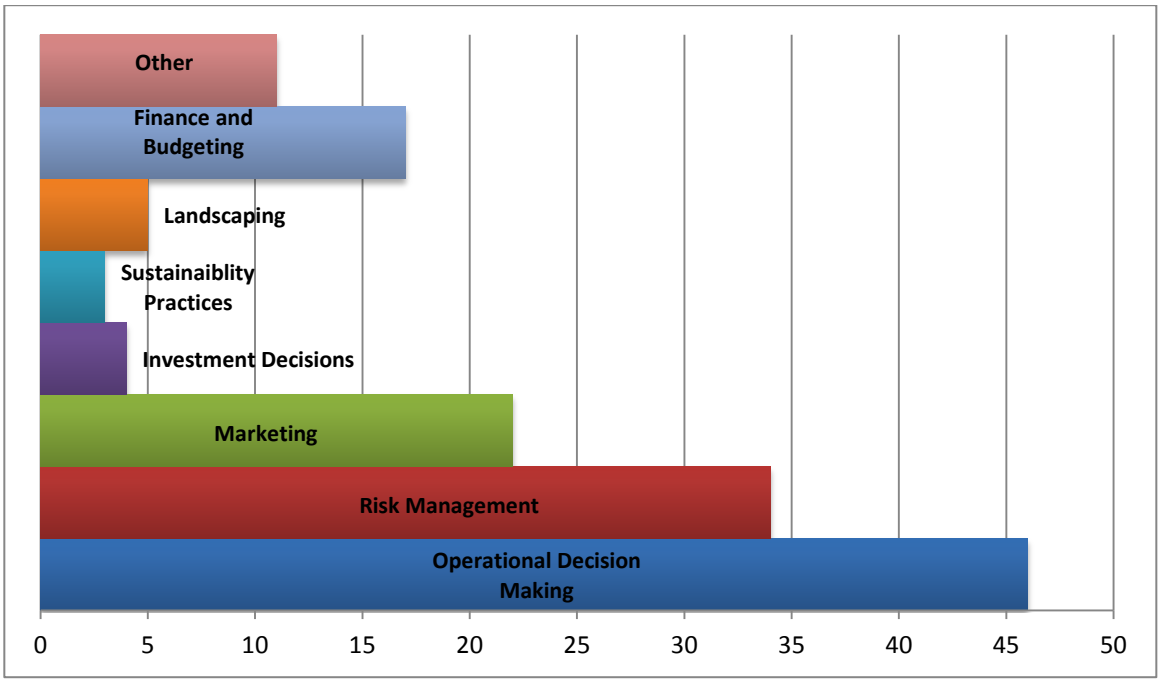

Figure 16: Frequency of individual responses of ways Weekly forecasts are used

Figure 17 compares the different weekly forecast uses to each other. With the lengthening of the forecast window, Operational Decision-Making becomes a more popular use of weekly forecasts compared to Risk Management. Marketing and Finance and Budgeting were similarly popular

uses of weekly forecasts with Other, Landscaping, Investment Decision and Sustainability Practices being the least popular uses of weekly forecasts.

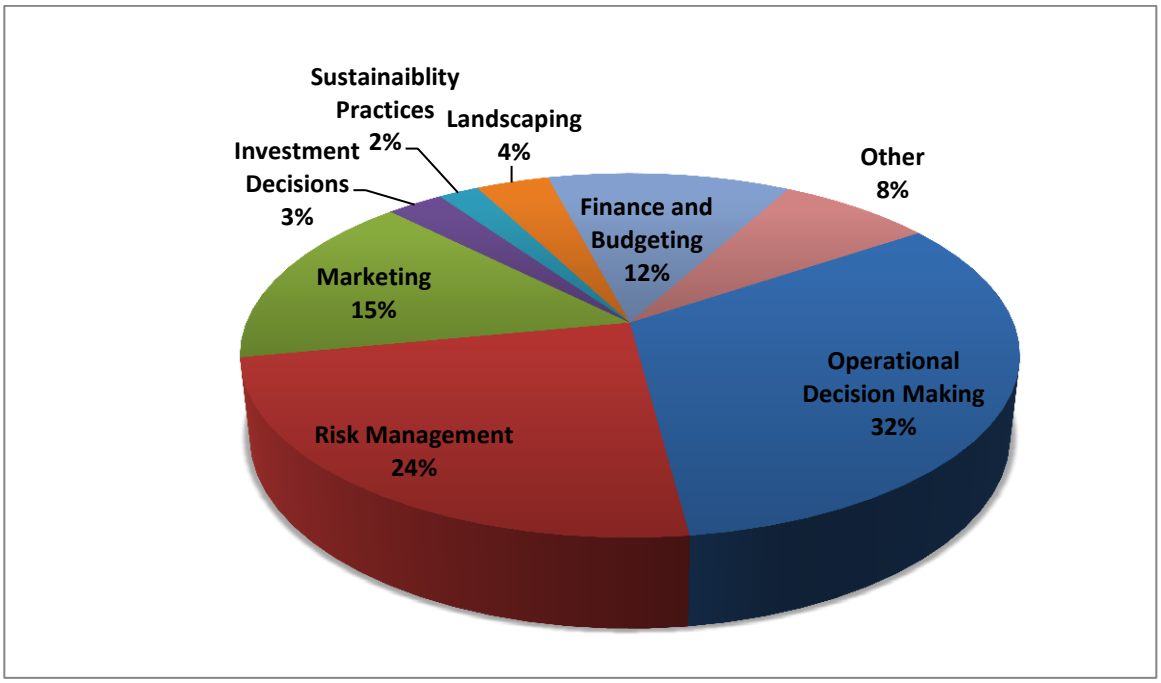

Figure 17: Comparison of different Weekly forecast uses to each other

Open-ended responses for weekly forecast use were examined for differences from the given categories. Displayed in Table 7 are respondents' specified uses.

Other Ways Weekly Forecasts are Used
Customer education/Guest Info (3 respondents)
Special Events cancellation decisions (3 respondents)
“During the shoulder seasons, I use weekly forecast to determine which days to operate”
“People eat rain or shine”
“Stock and inventories”
“Scheduling out of building procedures”
“Tournaments may be rescheduled due to a rainy forecast.”
“To predict occupancy”
“Specials on accommodations or storm related needs”
“Planning”
“Weather affects our guests decisions to come or stay home”
“Trying to ward off cancellations at the last minute when people think it might rain a day during their vacation”
“What days to go to the beach”
“Outside dining”
“Scheduling outdoor group activities”

Table 7: Open-ended responses for other Weekly forecast uses

Table 8 shows the number of respondents who chose a specific use of Weekly forecasts by Business Type. Percentages for each use of Weekly forecasts by Business Type is created by

taking each use of Weekly forecasts by Business Type out of the total uses of a given forecast for each business type. Highlighted are the high users of a specific use of Weekly forecasts.

	Operational Decision-Making	Risk Management	Marketing	Investment Decisions	Sustainability	Landscaping	Finance and Budgeting	Other	Total Usage Score by Business Type
Agriculture	28%	28%	14%	5%	2%	2%	12%	9%	**43**
Outdoor Recreation	32%	28%	16%	4%	2%	4%	12%	2%	**50**
Accommodations	27%	24%	20%	2%	0%	5%	9%	13%	**55**
Food Services	42%	16%	15%	3%	3%	1%	17%	3%	**69**
Parks and Heritage	29%	29%	14%	0%	5%	9%	0%	14%	**21**
Other	25%	33%	8%	0%	0%	0%	17%	17%	**12**
Total Times for a Specific Uses	**81**	**60**	**39**	**7**	**5**	**9**	**30**	**19**	

Table 8: Specific uses of Weekly forecasts by Business Type

Monthly forecasts were used in the following ways by respondents: Operational Decision-Making 6%, Risk Management 7%, Marketing 9%, Investment Decisions 3%, Sustainability Practices 1%, Landscaping 2%, Finance and Budgeting 7%, Other 2% (Figure 18).

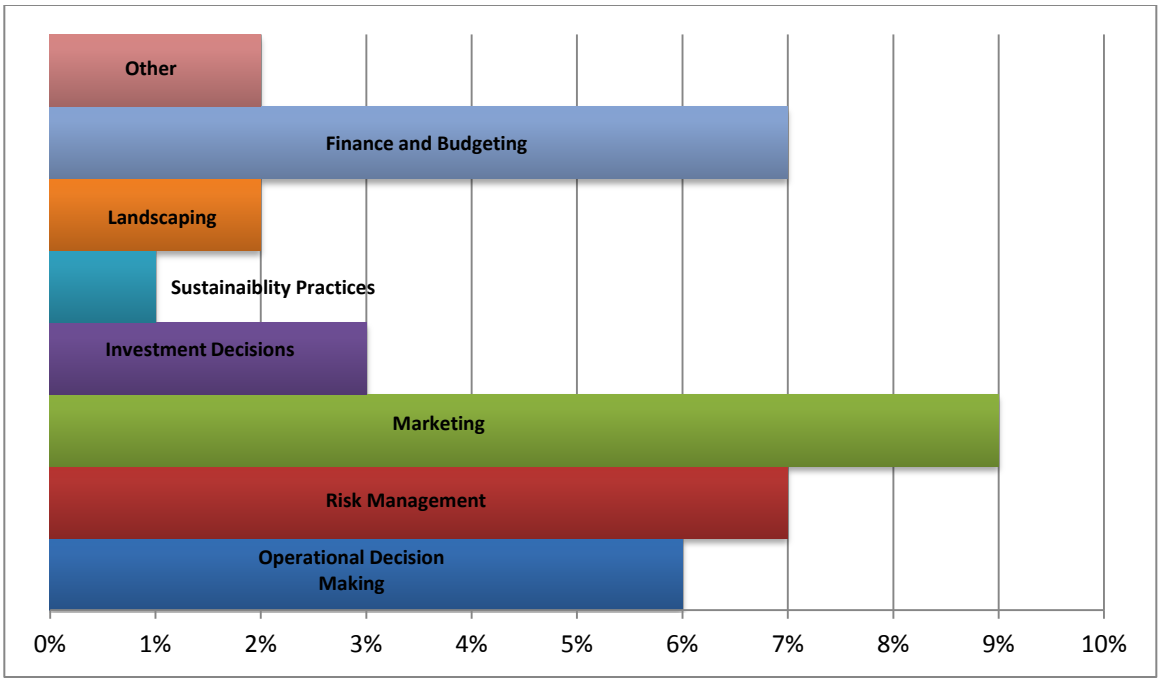

Figure 18: Frequency of individual responses of ways Monthly forecasts are used

Figure 19 compares the different monthly forecast uses to each other. Monthly forecasts were used differently than short-range forecasts. Marketing was the most popular use of monthly forecasts with Risk Management as the second most popular. Businesses made Finance and Budgeting and Operational Decisions to a similar extent using monthly forecasts.

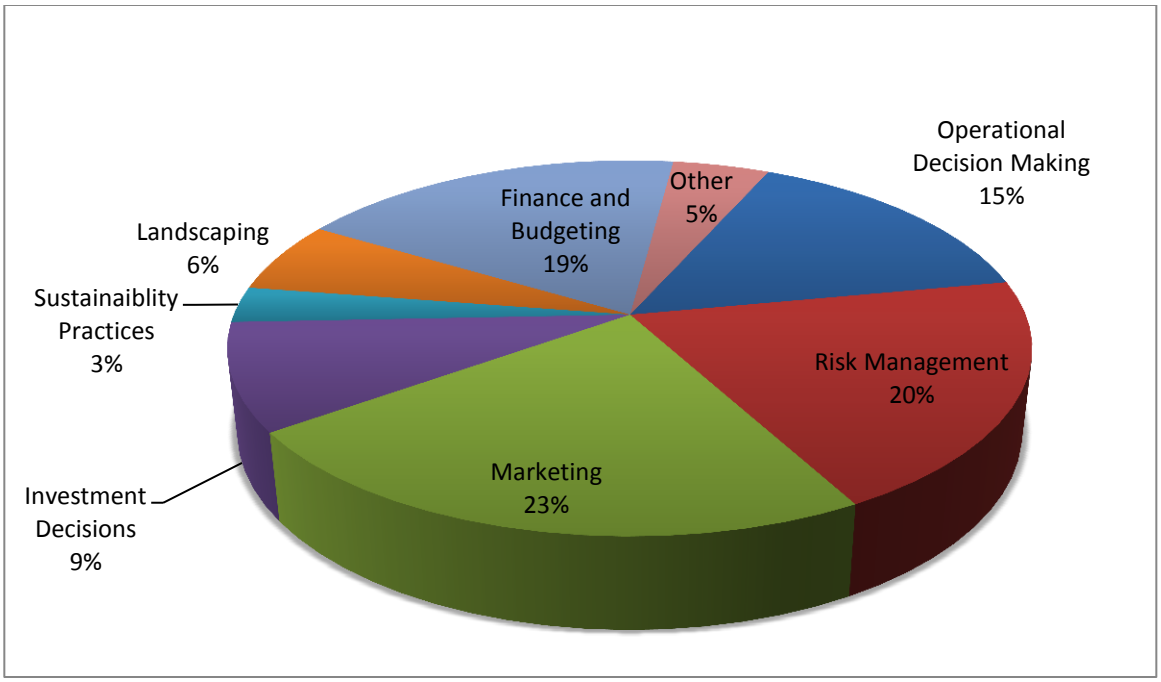

Figure 19: Comparison of different Monthly forecast uses to each other

Open-ended responses for monthly forecast use were examined for differences from the given categories. Displayed in Table 9 are respondents' specified uses.

Other Ways Monthly Forecasts are Used
"Maintenance contracting"
"Outside dining"

Table 9: Open-ended responses for other Monthly forecast uses

Table 10 shows the number of respondents who chose a specific use of Monthly forecasts by Business Type. Percentages for each use of Monthly forecasts by Business Type is created by

taking each use of Monthly forecasts by Business Type out of the total uses of a given forecast for each business type. Highlighted are the high users of a specific use of Monthly forecasts.

	Operational Decision-Making	Risk Management	Marketing	Investment Decisions	Sustainability	Landscaping	Finance and Budgeting	Other	Total Usage Score by Business Type
Agriculture	11%	23%	22%	11%	11%	11%	11%	0%	**9**
Outdoor Recreation	17%	22%	22%	4%	4%	9%	22%	0%	**23**
Accommodations	15%	23%	31%	7%	0%	8%	8%	8%	**13**
Food Services	23%	11%	22%	11%	0%	0%	22%	11%	**9**
Parks and Heritage	0%	50%	0%	0%	0%	0%	25%	25%	**4**
Other	14%	0%	28%	29%	0%	0%	29%	0%	**7**
Total Times for a Specific Uses	10	13	15	6	2	4	12	3	

Table 10: Specific uses of Monthly forecasts by Business Type

Seasonal forecasts were used in the following ways by respondents: Operational Decision-Making 6%, Risk Management 3%, Marketing 8%, Investment Decisions 5%, Sustainability Practices 2%, Landscaping 2%, Finance and Budgeting 8%, Other 2% (Figure 20).

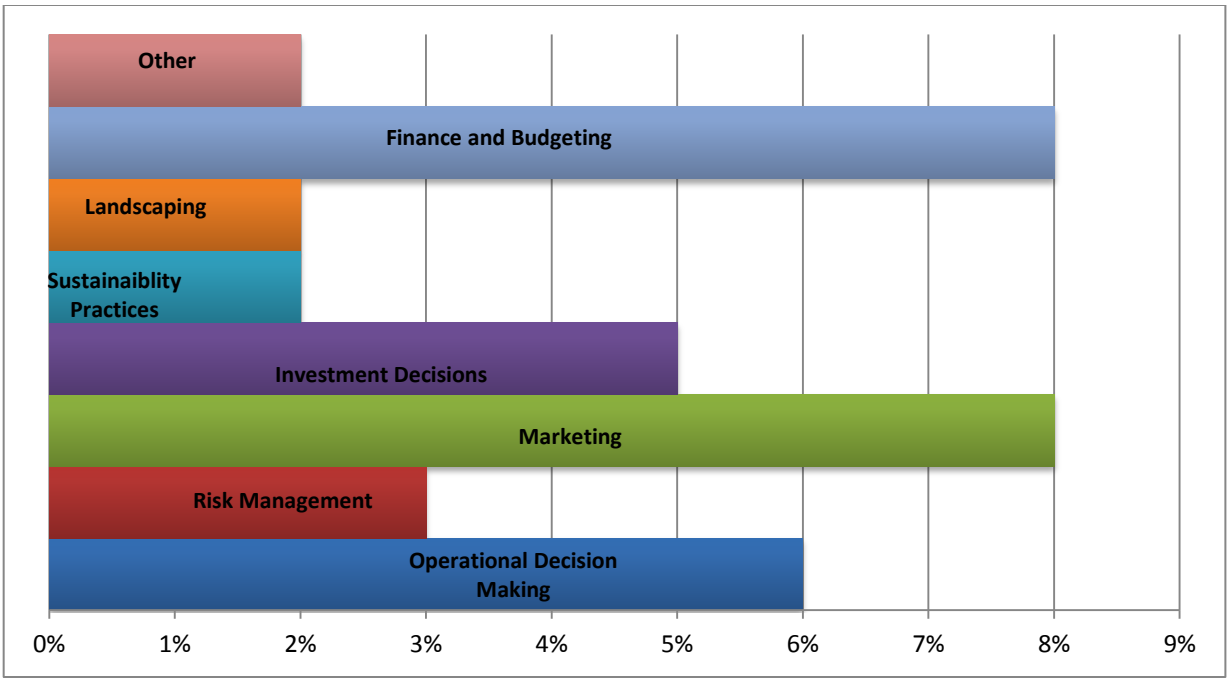

Figure 20: Frequency of individual responses of ways Seasonal forecasts are used

Figure 21 compares the different seasonal forecast uses to each other. Finance and Budgeting and Marketing were almost equally popular uses of seasonal forecasts. Operational Decision-Making was the third most popular with Investment Decisions and Risk Management following close behind. Sustainability Practices, Landscaping and Other were the least popular uses of seasonal forecasts.

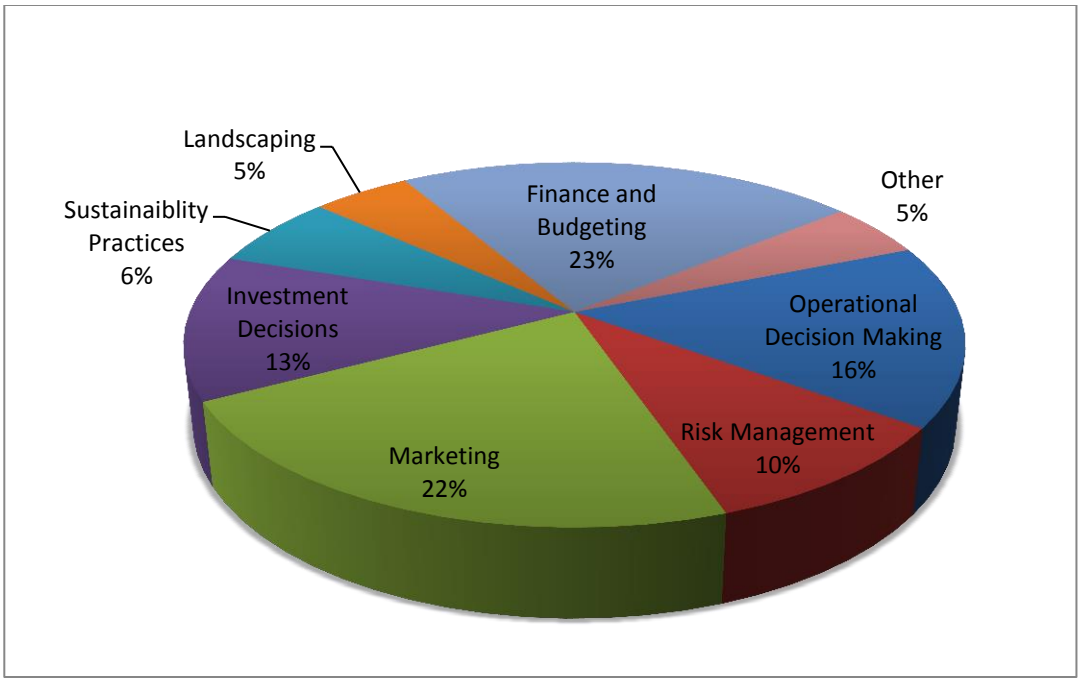

Figure 21: Comparison of different Seasonal forecast uses to each other

Open-ended responses for seasonal forecast use were examined for differences from the given categories. Displayed in Table 11 are respondents' specified uses.

Other Ways Seasonal Forecasts are Used
"Vacation accommodations are a seasonal business"
"Seasonal Storms cause evacuations"
"Event planning"

Table 11: Open-ended responses for other Seasonal forecast uses

Table 12 shows the number of respondents who chose a specific use of Seasonal Forecasts by Business Type. Percentages for each use of Seasonal forecasts by Business Type is created by taking each use of Seasonal forecasts by Business Type out of the total uses of a given forecast for each business type. Highlighted are the high users of a specific use of Seasonal forecasts.

	Operational Decision-Making	Risk Management	Marketing	Investment Decisions	Sustainability	Landscaping	Finance and Budgeting	Other	Total Usage Score by Business Type
Agriculture	25%	0%	25%	25%	25%	0%	0%	0%	**4**
Outdoor Recreation	9%	9%	18%	18%	9%	0%	37%	0%	**11**
Accommodations	17%	11%	33%	5%	6%	0%	22%	6%	**18**
Food Services	19%	12%	19%	13%	6%	0%	25%	6%	**16**
Parks and Heritage	0%	0%	0%	0%	0%	0%	0%	100%	**1**
Other	23%	11%	22%	22%	0%	0%	22%	0%	**9**
Total Times for a Specific Uses	**10**	**6**	**14**	**8**	**4**	**0**	**14**	**3**	

Table 12: Specific Uses of Seasonal forecasts by Business type

Other forecasts were used in the following ways by respondents: Operational Decision-Making 8%, Risk Management 3%, Marketing 1%, Investment Decisions 1%, Sustainability Practices 1%, Landscaping 2%, Finance and Budgeting 3%, Other 1% (Figure 22).

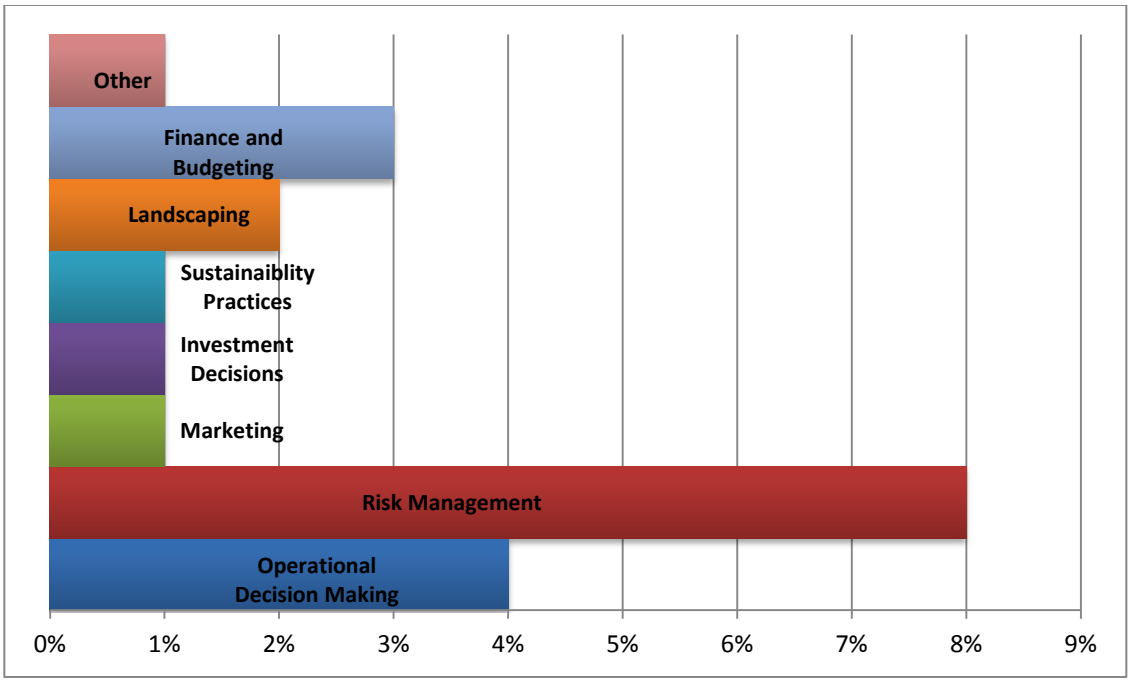

Figure 22: Frequency of individual responses of ways Other forecasts are used

Figure 23 compares the different other forecast uses to each other. Risk Management was the most popular use of other forecasts. Operational Decision-Making and Finance and Budgeting were similarly popular uses of other forecasts. Landscaping, Other, Investment Decisions and Marketing were less popular uses of other forecasts with Sustainability Practices being the least popular use of other forecasts.

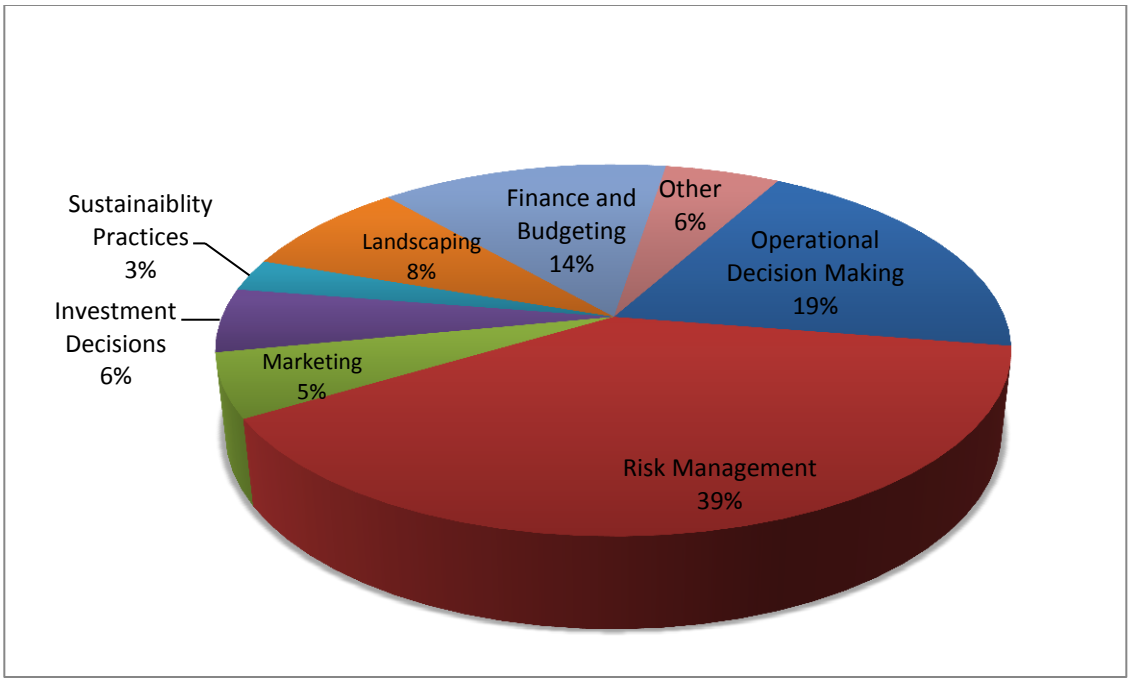

Figure 23: Comparison of different Other forecast uses to each other

Open-ended responses for other forecast use were examined for differences from the given categories. Displayed in Table 13 are respondents' specified uses.

Other Ways Other Forecasts are Used
"Hurricane prep"
"We are a haul out facility for other vessels in the area during hurricane season, so we need to know when to prepare for that."

Table 13: Open-ended responses for remaining Other forecast uses

Table 14 shows the number of respondents who chose a specific use of Other Forecasts by Business Type. Percentages for each use of Other forecasts by Business Type is created by

taking each use of Other forecasts by Business Type out of the total uses of a given forecast for each business type. Highlighted are the high users of a specific use of Other forecasts.

	Operational Decision-Making	Risk Management	Marketing	Investment Decisions	Sustainability	Landscaping	Finance and Budgeting	Other	Total Usage Score by Business Type
Agriculture	20%	60%	0%	0%	0%	0%	20%	0%	**5**
Outdoor Recreation	50%	37%	0%	0%	0%	13%	0%	0%	**8**
Accommodations	8%	38%	8%	8%	0%	15%	23%	0%	**13**
Food Services	0%	100%	0%	0%	0%	0%	0%	0%	**2**
Parks and Heritage	0%	0%	0%	0%	0%	0%	0%	0%	**0**
Other	20%	20%	20%	20%	0%	0%	20%	0%	**5**
Total Times for a Specific Uses	**7**	**14**	**2**	**2**	**0**	**3**	**5**	**0**	

Table 14: Specific uses of Other forecasts by Business Type

Respondents were asked why they do not use hourly, daily, weekly, monthly and seasonal forecasts. Reasons for not using hourly forecasts include: Did not Know They were Available 1%, Too Technical 2%, Not Important 33%, Other 12% (Figure 24).

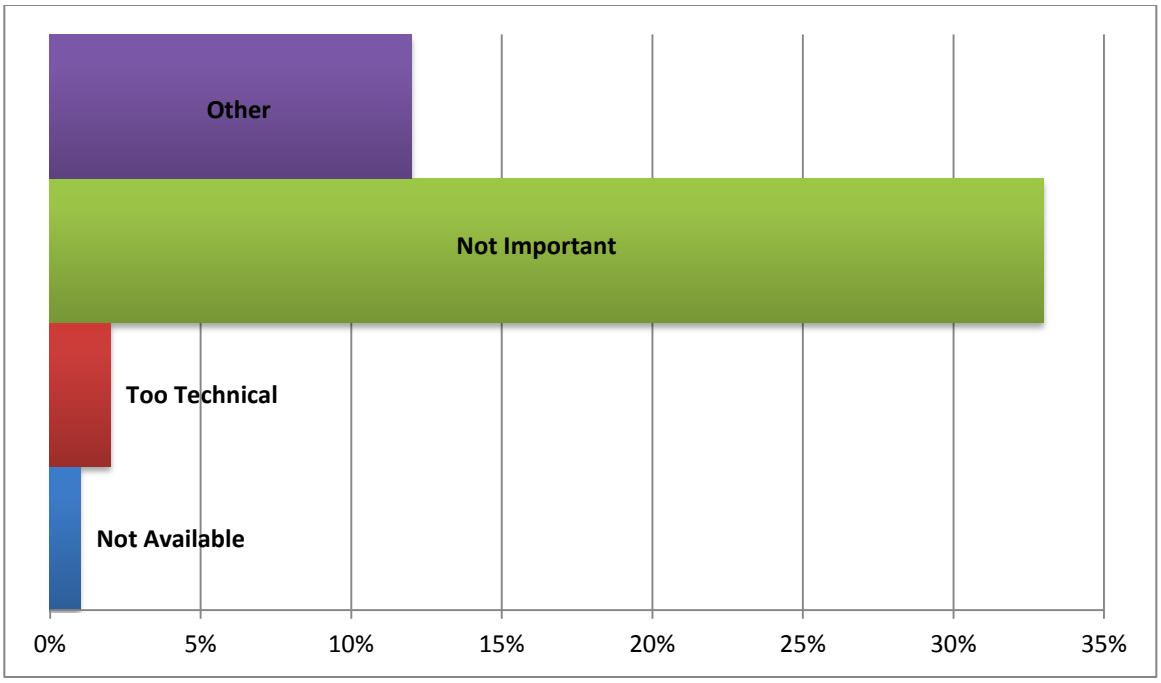

Figure 24: Frequency of individual responses of reasons for not using Hourly forecasts

Open-ended responses for why hourly forecasts were not used were examined for differences from the given categories. Displayed in Table 15 are respondents' specified reasons.

Other Reasons Why Hourly Forecasts are Not Used

Not enough time to make changes to our plans (2 respondents) "Weather is usually unpredictable" "Planning is longer ranged" "Do use if looking at wind conditions for ferries" "Reservations are made months in advance. Need weekly forecast to appease people calling just ahead of arrival that want to" "Usually too busy serving the patrons to check hourly" "Travelers to our area travel an average 1-5 hrs. to get to our business....we find hourly forecasts change often" "Only Used during periods of bad weather"

Table 15: Open-ended responses for why Hourly forecasts are not used

Eighty-five people did not use Hourly forecasts. The following frequencies show the percentage of each business type not using Hourly forecasts: Agriculture (11%), Outdoor Recreation (13%), Accommodations (32%), Food Services (32%), Parks and Heritage (6%), and Other (6%). Table 16 shows the number of respondents who chose a specific reason for not using Hourly Forecast by Business Type. Non-importance was the biggest reason for not using Hourly forecasts with Accommodations representing the largest portion of responses for this reason.

	Did Not Know They Were Available	**Too Technical**	**Not Important**	**Other Reason**	**Total not Using Hourly Forecasts**
Agriculture	9%	0%	55%	36%	10
Outdoor Recreation	0%	9%	73%	18%	11

Accommodations	0%	3%	74%	22%	27
Food Services	4%	4%	66%	26%	27
Parks and Heritage	0%	17%	66%	17%	5
Other	0%	0%	60%	40%	5

Table 16: Specific reasons for not using Hourly forecasts by Business Type

Reasons for not using daily forecasts include: Did not Know They were Available 1%, Too Technical 2%, Not Important 20%, Other 12% (Figure 25).

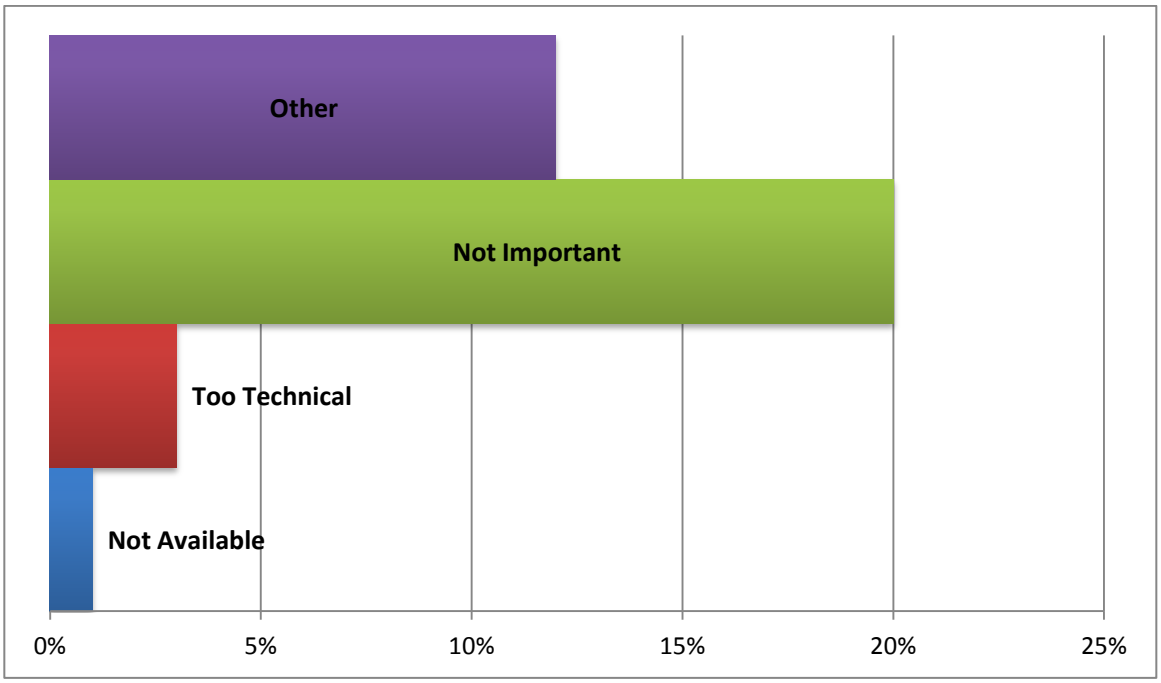

Figure 25: Frequency of individual responses of reasons for not using Daily forecasts

Open-ended responses for why daily forecasts were not used were examined for differences from the given categories. Displayed in Table 17 below are respondents' specified reasons.

Other Reasons Why Daily Forecasts are Not Used
"Not enough detail"
"Weather is unpredictable"
"Not precise enough"
"Can't make the weather different"
"Too short term"
"Not always important, used to plan outdoor events & staffing during poor weather"

Table 17: Open-ended responses for other reasons why Daily forecasts were not used

Sixty-four people did not use Daily forecasts. The following frequencies show the percentage of each business type not using Daily forecasts: Agriculture (2%), Outdoor Recreation (17%), Accommodations (33%), Food Services (34%), Parks and Heritage (5%), and Other (9%). Table 18 shows the number of respondents who chose a specific reason for not using Daily Forecasts by Business Type. Non-importance and Other reasons contributed to non-use of Daily forecasts with Accommodations, Food Services and Parks and Heritage indicating Non-Importance and Agriculture, Outdoor Recreation and Other sectors indicating Other Reasons.

	Did Not Know They Were Available	Too Technical	Not Important	Other Reason	Total not Using Daily Forecasts
Agriculture	0%	0%	0%	100%	1
Outdoor Recreation	0%	18%	27%	55%	11
Accommodations	0%	5%	57%	38%	21
Food Services	0%	0%	80%	20%	22

Parks and Heritage	0%	33%	67%	0%	3
Other	0%	17%	33%	50%	6

Table 18: Specific reasons for not using Daily forecasts by Business Type

Reasons for not using weekly forecasts include: Not Available 0%, Too Technical 2%, Not Important 15%, Other 14%. No one indicated not knowing that weekly forecasts were available (Figure 4.25).

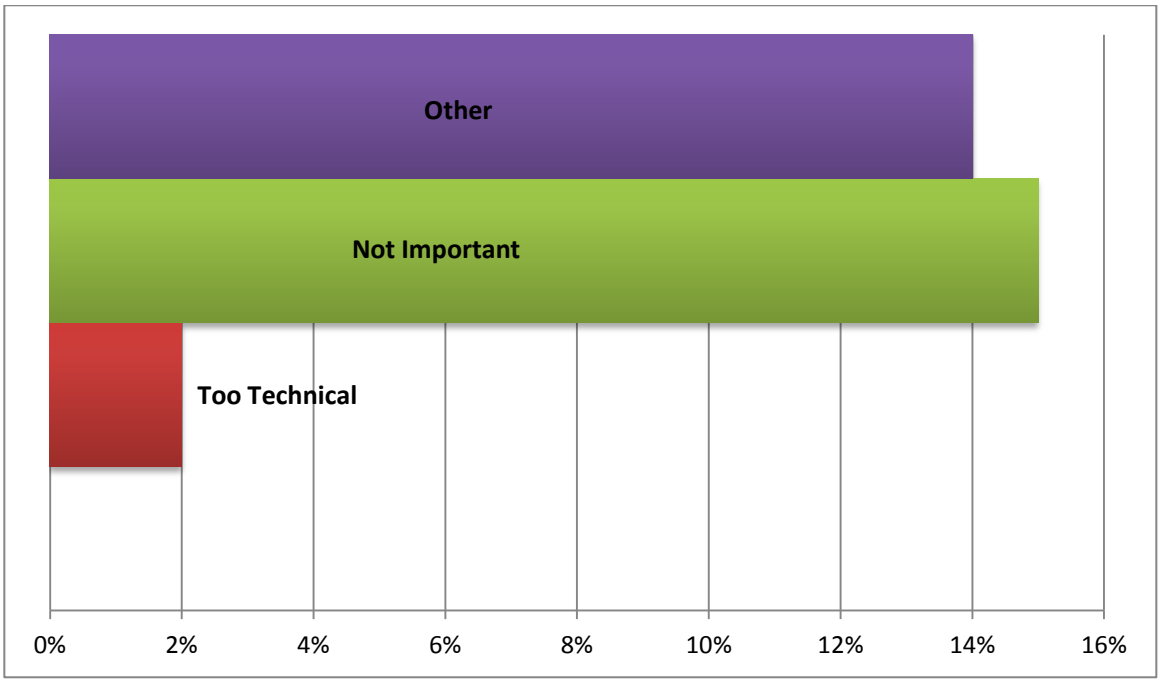

Figure 26: Frequency of individual responses of reasons for not using Weekly forecasts

Open-ended responses for why weekly forecasts were not used were examined for differences from the given categories. Displayed in Table 19 are respondents' specified reasons.

Other Reasons Why Weekly Forecasts are Not Used

Unreliable (5 respondents) Not enough detail (3 respondents) Too short term (2 respondents) Not applicable (3 respondents)

Table 19: Open-ended responses why Weekly forecasts were not used

Fifty-four people did not use Weekly forecasts. The following frequencies show the percentage of each business type not using Weekly forecasts: Agriculture (9%), Outdoor Recreation (22%), Accommodations (20%), Food Services (33%), Parks and Heritage (5%), and Other (11%). Table 20 shows the number of respondents who chose a specific reason for not using Weekly Forecasts by Business Type. Non-importance was the indicated by Food Services, Parks and Heritage and Other sectors as the reason for not using Weekly forecasts. Agriculture, Outdoor Recreation and Accommodations indicated Other Reasons for not using Weekly forecasts.

	Did Not Know They Were Available	Too Technical	Not Important	Other Reason	Total not Using Weekly Forecasts
Agriculture	0%	0%	20%	80%	5
Outdoor Recreation	0%	8%	25%	67%	12
Accommodations	0%	0%	27%	36%	11
Food Services	0%	11%	61%	28%	18
Parks and Heritage	0%	33%	67%	0%	2
Other	0%	0%	50%	50%	6

Table 20: Specific reasons for not using Weekly forecasts by Business Type

Reasons for not using monthly forecasts include: Not Available 2%, Too Technical 3%, Not Important 46%, Other 37%. No one indicated that weekly forecasts were Too Technical (Figure 27).

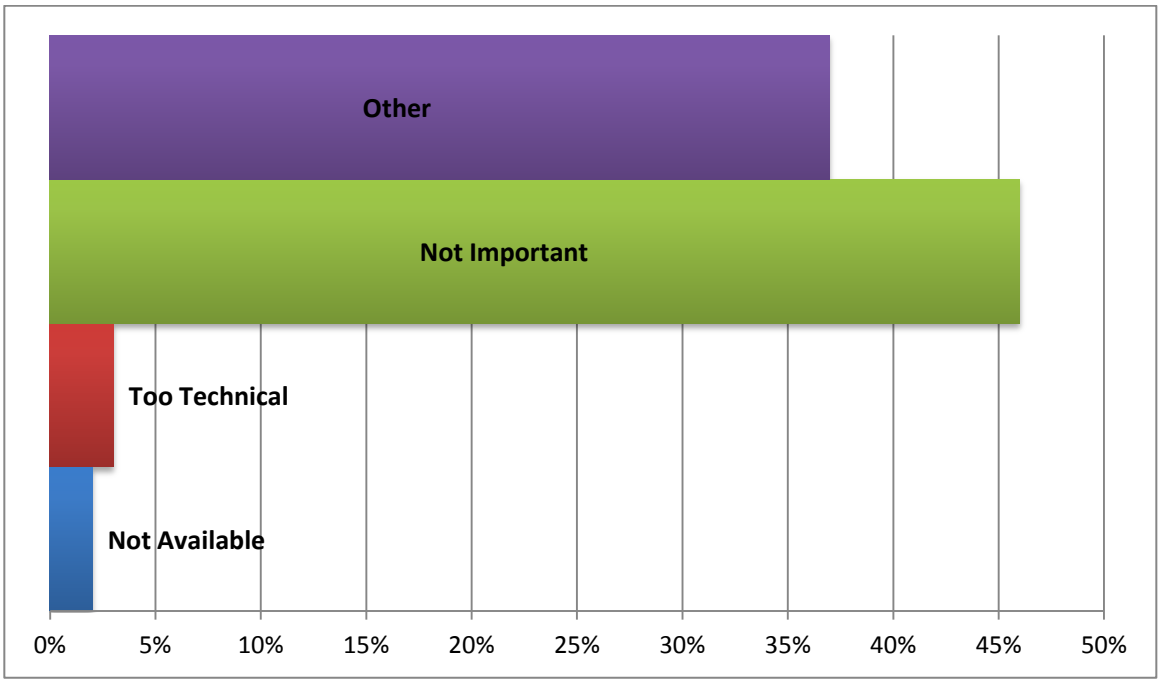

Figure 27: Frequency of individual responses of reasons for not using Monthly forecasts

Open-ended responses for why monthly forecasts were not used were examined for differences from the given categories. Displayed in Table 21 are respondents' specified reasons.

Other Reasons Why Monthly Forecasts are Not Used
Inaccurate (14 respondents)
Not Reliable (14 respondents)
Weather changes too much (5 respondents)
Not applicable (4 respondents)
Not enough detail (2 respondents)
Too far in advance (6 respondents)
“Weather prediction in coastal NC is too unpredictable to put to much weight in it”
“Don't need to get that specific.”
“They are more often then not wrong!”
“People eat rain or shine...”
“Help with temperature, but rain forecast is too unpredictable for long-term”
“Only important for event planning and inclement weather staffing”
“No one knows the weather a month out”

Table 21: Open ended responses for why Monthly forecasts were not used

One hundred fifty-two people did not use Monthly forecasts. The following frequencies show the percentage of each business type not using Monthly forecasts: Agriculture (13%), Outdoor Recreation (17%), Accommodations (23%), Food Services (33%), Parks and Heritage (7%), and Other (7%). Table 22 shows the number of respondents who chose a specific reason for not using

Monthly Forecasts by Business Type. Non-importance was the biggest reason for not using Monthly forecasts with Outdoor Recreation, Accommodations, Food Services, and Parks and Heritage representing the largest portion of responses for this reason. Agriculture, Parks and Heritage and Other sectors indicated Other Reasons for not using Monthly forecasts.

	Did Not Know They Were Available	Too Technical	Not Important	Other Reason	Total not Using Monthly Forecasts
Agriculture	5%	0%	43%	52%	20
Outdoor Recreation	4%	4%	50%	42%	26
Accommodations	5%	5%	49%	41%	35
Food Services	0%	4%	67%	33%	50
Parks and Heritage	0%	0%	50%	50%	10
Other	0%	0%	36%	64%	11

Table 22: Specific reasons for not using Monthly forecasts by Business Type

Reasons for not using seasonal forecasts include: Not Available 2%, Too Technical 6%, Not Important 48%, and Other 35% (Figure 28).

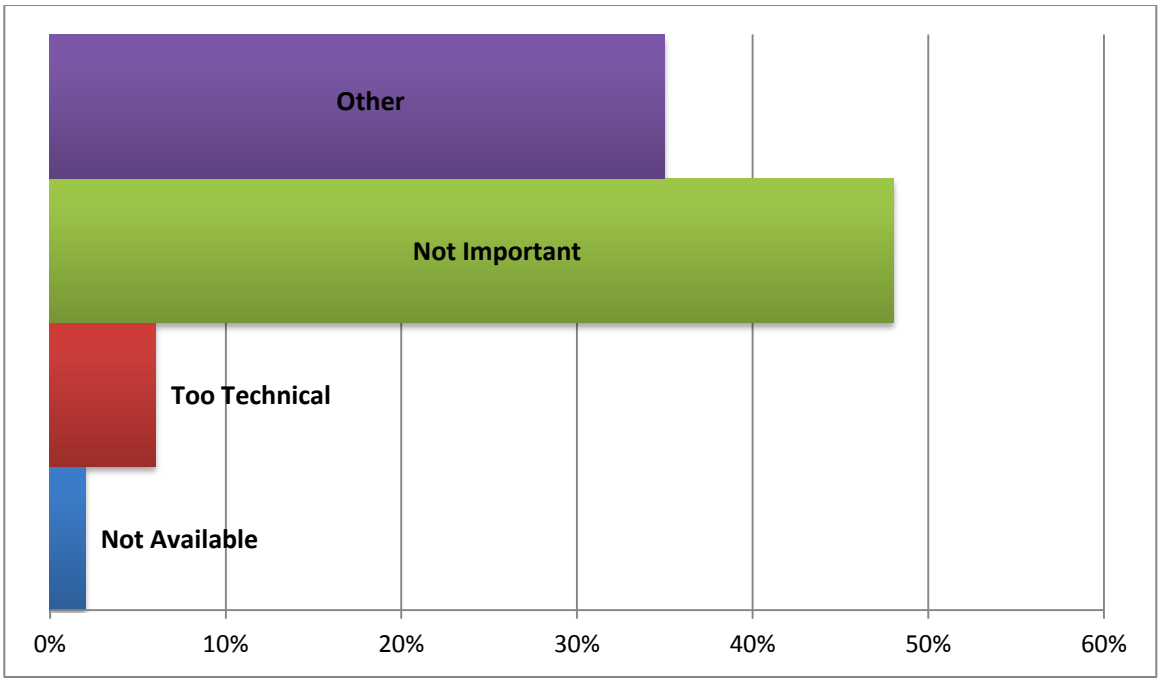

Figure 28: Frequency of individual responses of reasons for not using Seasonal forecasts

Open-ended responses for why seasonal forecasts were not used were examined for differences from the given categories. Displayed in Table 23 are respondents' specified reasons.

Other Reasons Why Seasonal Forecasts are Not Used
Inaccurate (13 respondents)
Unreliable (17 respondents)
Not enough detail (2 respondents)
Not applicable (6 respondents)
“We usually operate indoors and can schedule our outside activities when weather permits”
“Unless its a hurricane it doesn't affect us”
“Used less as they pinpoint larger geographic areas and may not pertain to our coastal outlook”
“They are not reliable enough to impact decisions. They are generally to broad to impact us.”
“Used more by our customers that me as business owner”
“Low confidence in judging behavior over a week out”
“Our seasons are relatively stable from one yr to the next”
“Broad view is that winter, spring, summer, fall in one particular reason is pretty standard & normalized”
“People don't get married on the beach in winter”
“Too far off from events”

Table 23: Open-ended responses for why Seasonal forecasts were not used

One hundred fifty-six people did not use Seasonal forecasts. The following frequencies show the percentage of each business type not using Seasonal forecasts: Agriculture (14%), Outdoor Recreation (18%), Accommodations (22%), Food Services (31%), Parks and Heritage (8%), and Other (7%). Table 24 shows the number of respondents who chose a specific reason for not using Seasonal Forecasts by Business Type. Non-Importance was indicated by all sectors except Agriculture who chose Other Reasons for not using Seasonal forecasts. Parks and Heritage also indicated Other Reasons for not using Seasonal forecasts.

	Did Not Know They Were Available	Too Technical	Not Important	Other Reason	Total not Using Seasonal Forecasts
Agriculture	4%	4%	43%	49%	22
Outdoor Recreation	4%	7%	54%	36%	28
Accommodations	0%	9%	54%	37%	34
Food Services	2%	10%	55%	33%	48
Parks and Heritage	8%	0%	46%	46%	13
Other	0%	0%	58%	42%	11

Table 24: Specific reasons for not using Seasonal forecasts by Business Type

Overall Forecast Usefulness

For each temporal scale of forecast, respondents were asked to check all the ways in which they use a given forecast including Hourly, Daily, Weekly, Monthly, Seasonal and Other types. The number of uses checked was added for a total usefulness score for each temporal scale of forecast; Respondents could potentially earn a usefulness score of 8 if they checked all given uses for a forecast. Hourly forecast usefulness scores ranged from zero to six with the following

frequencies: Zero 48%, One 25%, Two 16%, Three 7%, Four 2%, Five 1%, Six 1%, and Seven 1% (*M* = .95). Hourly forecast usefulness was non-normally distributed with a skewness of 1.43 (SE = .183) and a kurtosis of 2.20 (SE = .363). Figure 29 displays the distribution of hourly forecast usefulness scores.

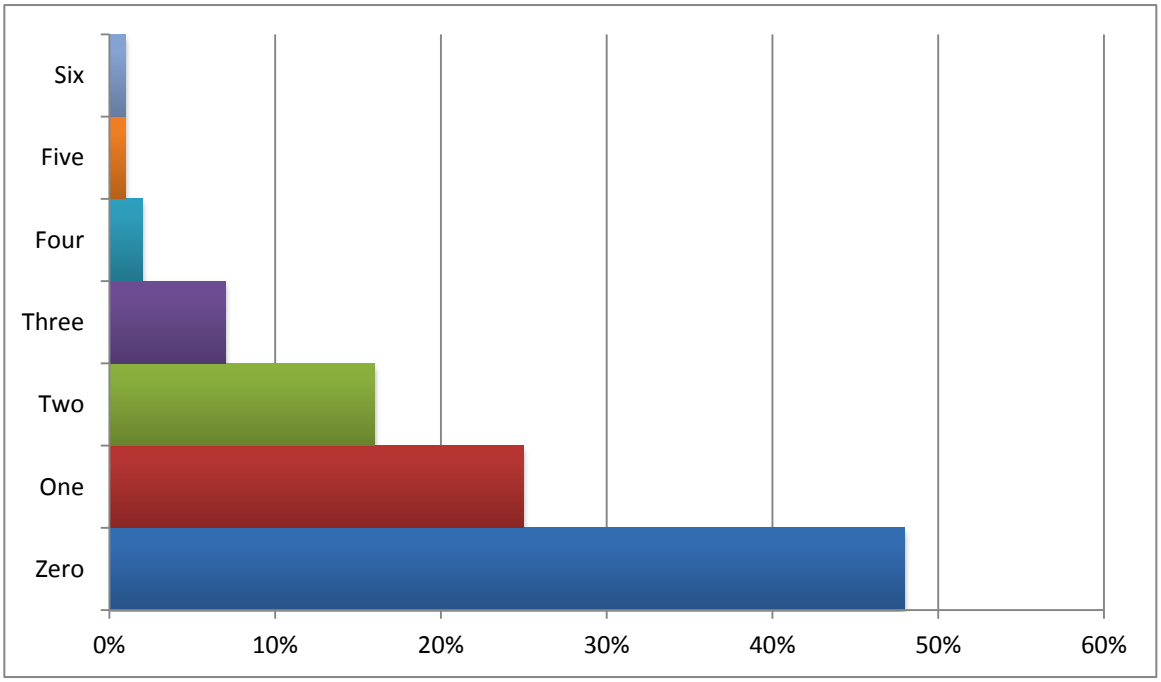

Figure 29: Overall Hourly forecast usefulness for all respondents

Daily forecast usefulness scores ranged from zero to six with the following frequencies: Zero 36%, One 27%, Two 24%, Three 8%, Four 2%, Five 2%, and Six 1% (*M* = 1.20). Daily forecast usefulness was non-normally distributed with a skewness of 1.10 (SE = .183) and a kurtosis of 1.54 (SE = .363). Figure 30 displays the distribution of daily usefulness scores.

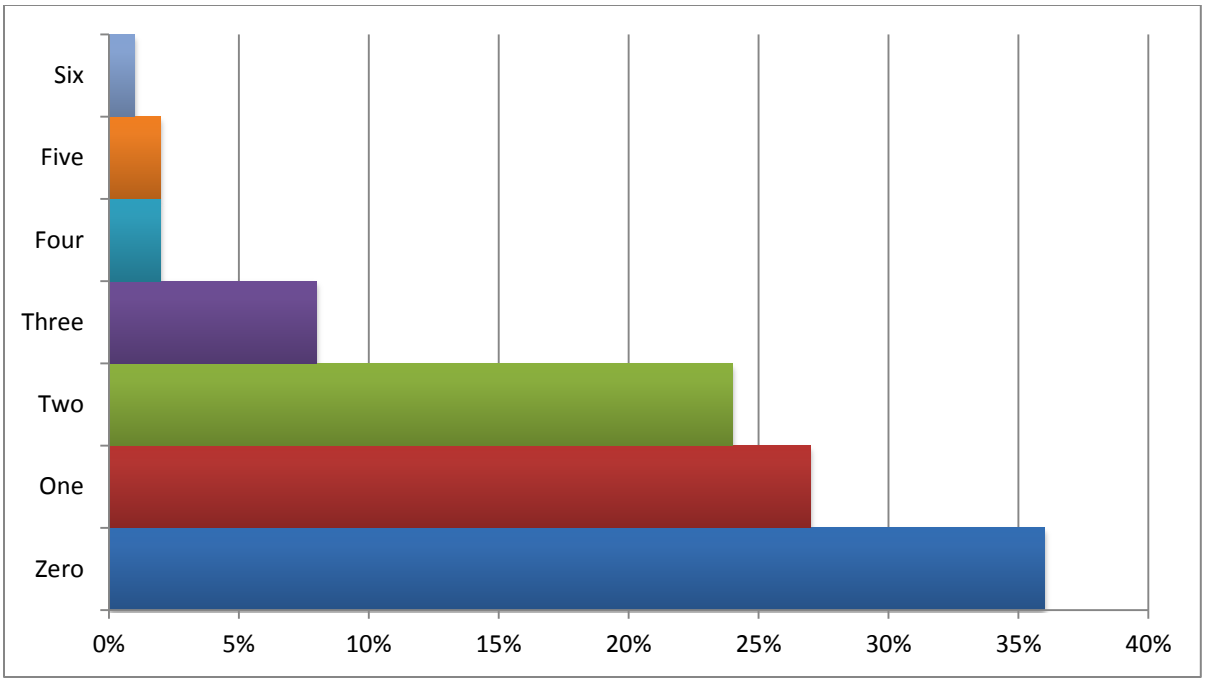

Figure 30: Overall Daily forecast usefulness for all respondents

Weekly forecast usefulness scores ranged from zero to seven with the following frequencies: Zero 34%, One 29%, Two 20%, Three 9%, Four 5%, Five 1%, Six 2%, Seven 1% (*M* = 1.41). Weekly forecast usefulness was non-normally distributed with a skewness of 1.28 (SE = .183) and a kurtosis of 1.87 (SE = .363). Figure 31 displays the distribution of weekly usefulness scores.

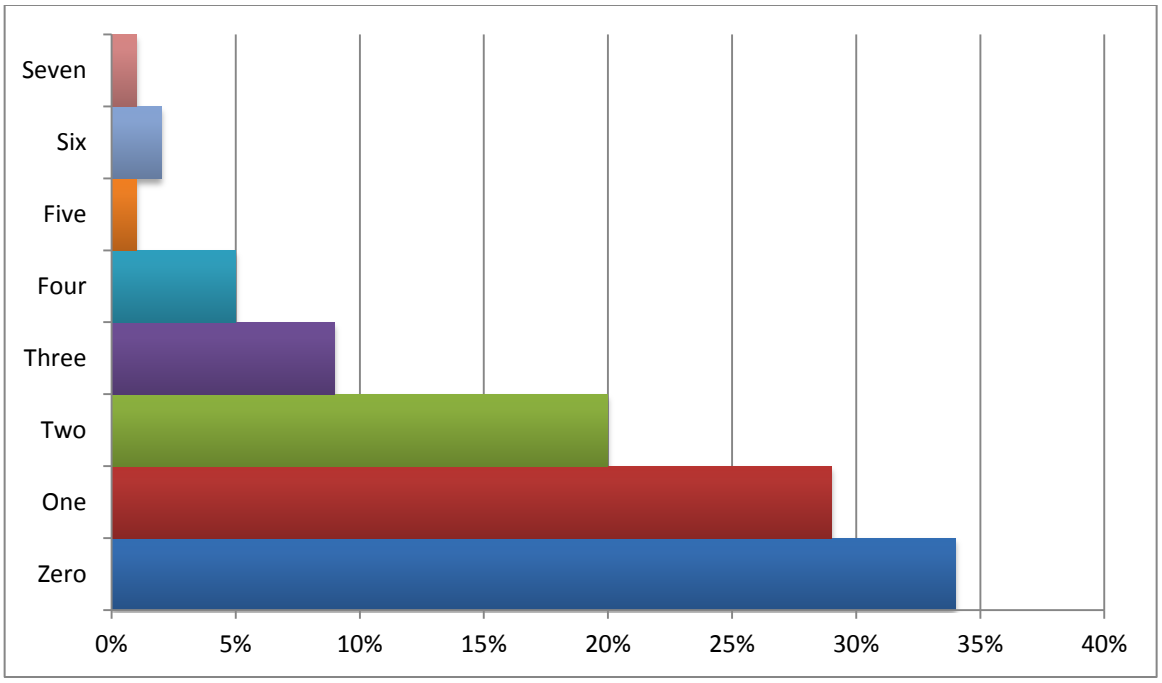

Figure 31: Overall Weekly forecast usefulness for all respondents

Monthly forecast usefulness scores ranged from zero to six with the following frequencies: Zero 86%, One 6%, Two 2%, Three 3%, Four 1%, Five 1%, and Six 1% (*M* = 1.14). Monthly forecast usefulness was non-normally distributed with a skewness of 3.85 (SE = .183) and a kurtosis of 16.06 (SE = .363). Figure 32 displays the distribution of monthly usefulness scores.

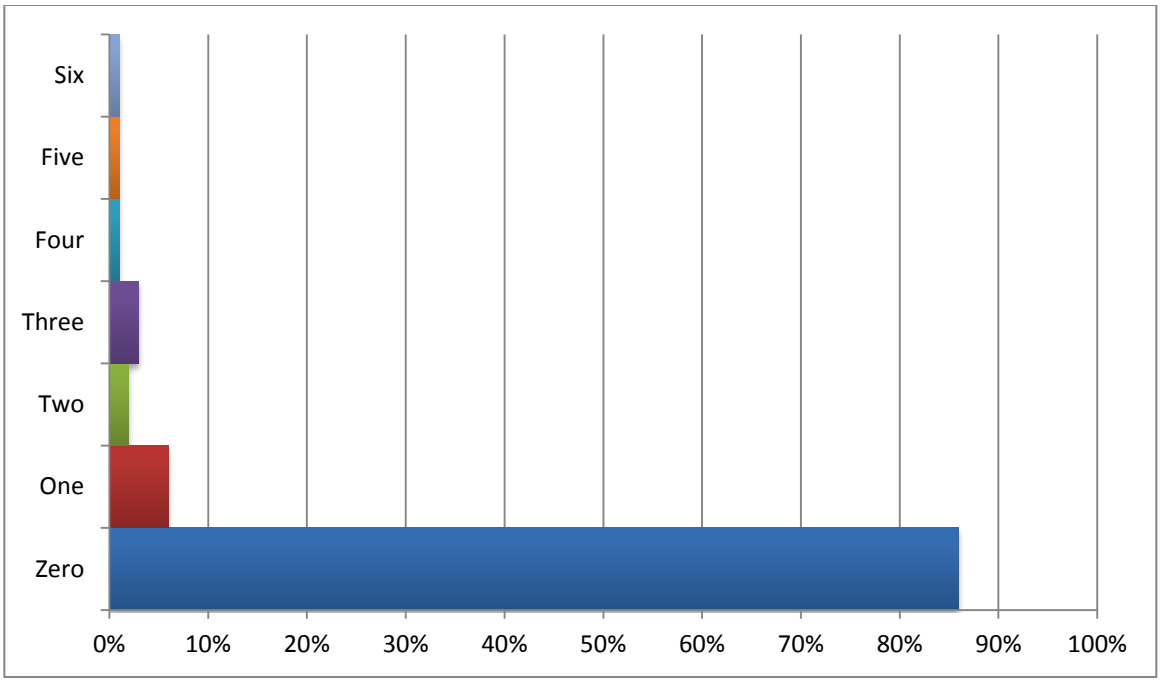

Figure 32: Overall Monthly forecast usefulness for all respondents

Seasonal forecast usefulness scores ranged from zero to six with the following frequencies: Zero 88%, One 4%, Two 2%, Three 1%, Four 1%, Five 2%, and Six 1% (*M* = .35). Seasonal forecast usefulness was non-normally distributed with a skewness of 3.78 (SE = .183) and a kurtosis of 14.34 (SE = .363). Figure 33 displays the distribution of seasonal usefulness scores.

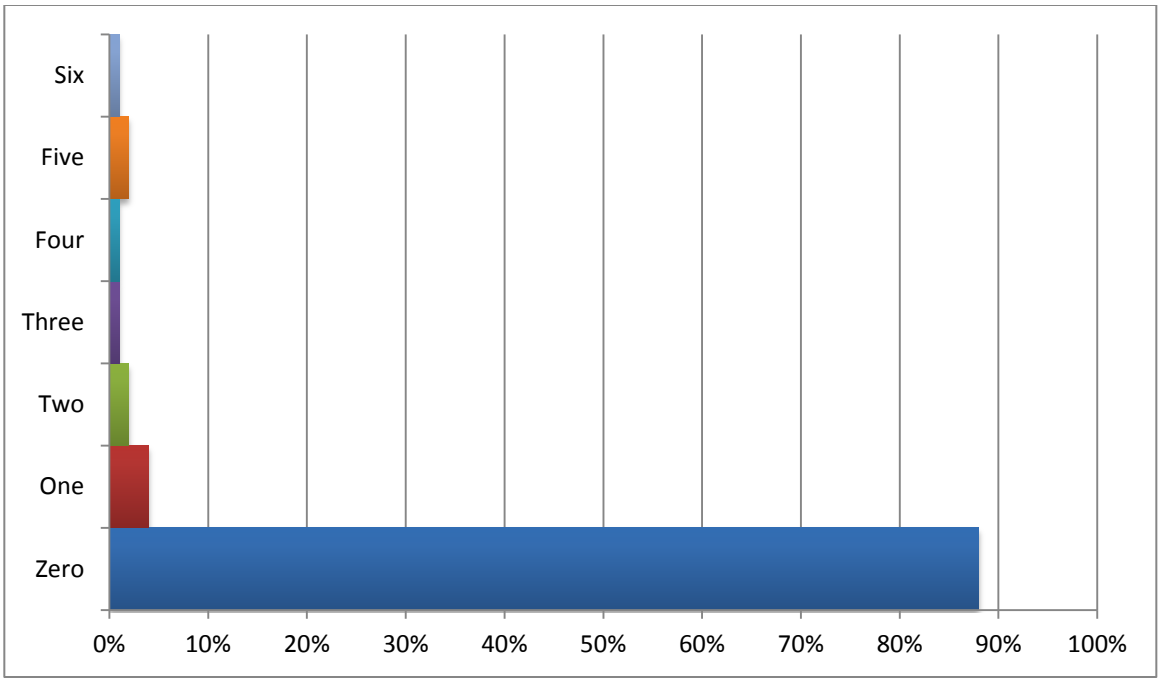

Figure 33: Overall Seasonal forecast usefulness for all respondents

Other forecast usefulness scores represented four different possible scores including: Zero 48%, One 3%, Two 2%, Three 2% and Five 1% (M = .20). Other forecast usefulness was non-normally distributed with a skewness of 4.42 (SE = .183) and a kurtosis of 21.16 (SE = .363). Figure 34 displays the distribution of other usefulness scores.

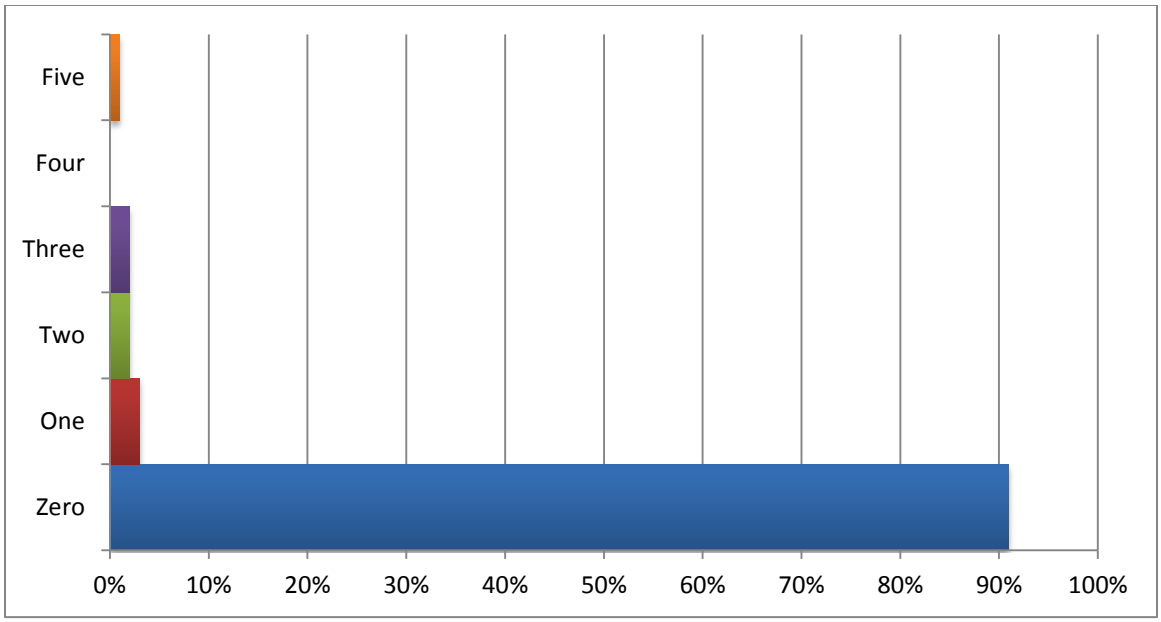

Figure 34: Overall Other forecast usefulness for all respondents

In summary, weekly weather forecasts are used by coastal tourism businesses more than any other forecast.

Forecast Value

Each respondent was asked to rank on a scale from one to five the value of each type of forecast. Figure 35 displays the frequency of values given to hourly forecasts including: One 54%, Two 7%, Three 14%, Four 12%, Five 22% (*M* = 2.23). Hourly Forecast Value was normally distributed with a skewness of .728 (SE = .183) and slightly leptokurtic at -1.04 (SE = .363). The majority of businesses did not find value in Hourly forecasts, but a substantial number found them highly valuable.

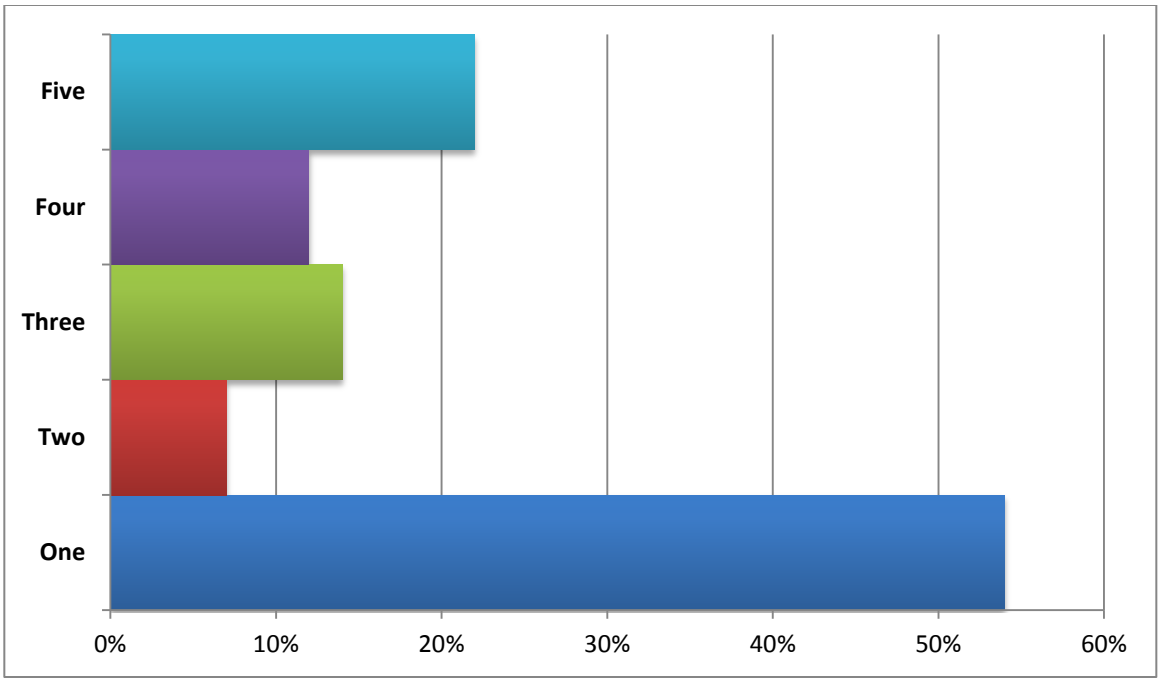

Figure 35: Hourly forecast value indicated by all respondents

Figure 36 displays the frequency of values given to daily forecasts including: One 41%, Two 11%, Three 16%, Four 15%, Five 18% (*M* = 2.56). Daily Forecast Value was normally distributed with a skewness of .370 (SE = .183) and slightly leptokurtic at -1.417 (SE = .363). In a probabilistic sense, a typical business did not find value in Daily forecasts, but almost 60% of businesses found them to have some value.

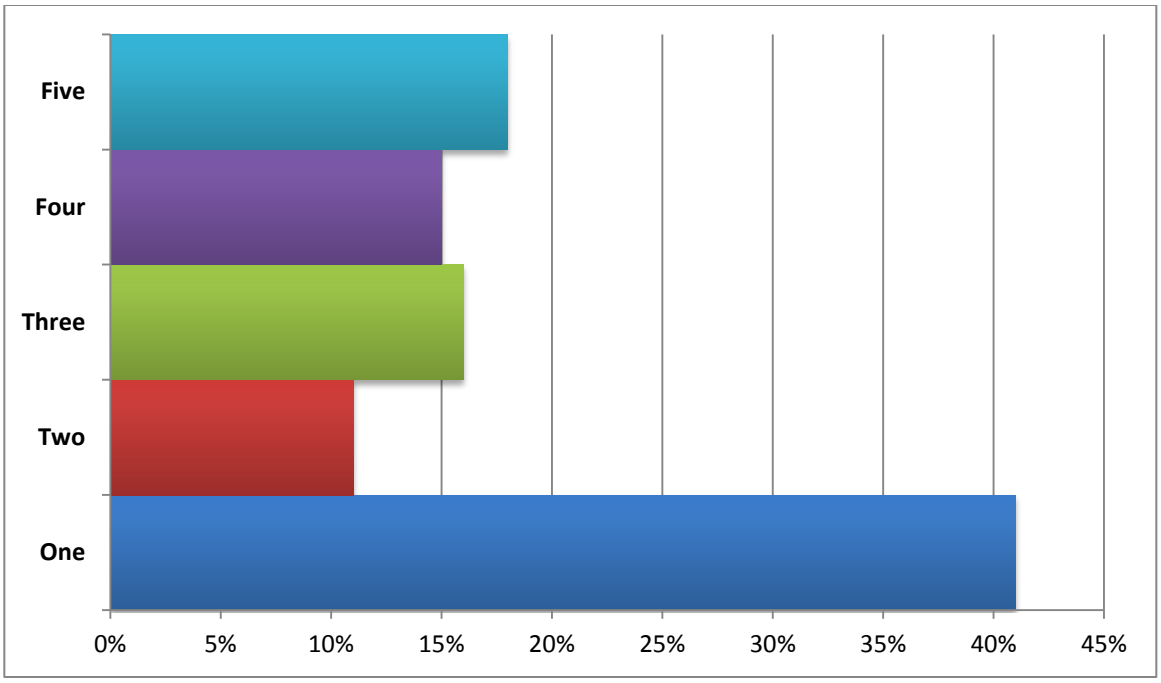

Figure 36: Daily forecast value indicated by all respondents

Figure 37 displays the frequency of values given to weekly forecasts including: One 35%, Two 8%, Three 28%, Four 17%, Five 12% (*M* = 2.64). Weekly Forecast Value was normally distributed with a skewness of .182 (SE = .183) and slightly leptokurtic at -1.282 (SE = .363). While the most common response is for no value from the weekly forecast, over 25% of businesses rate this forecast as a 3.

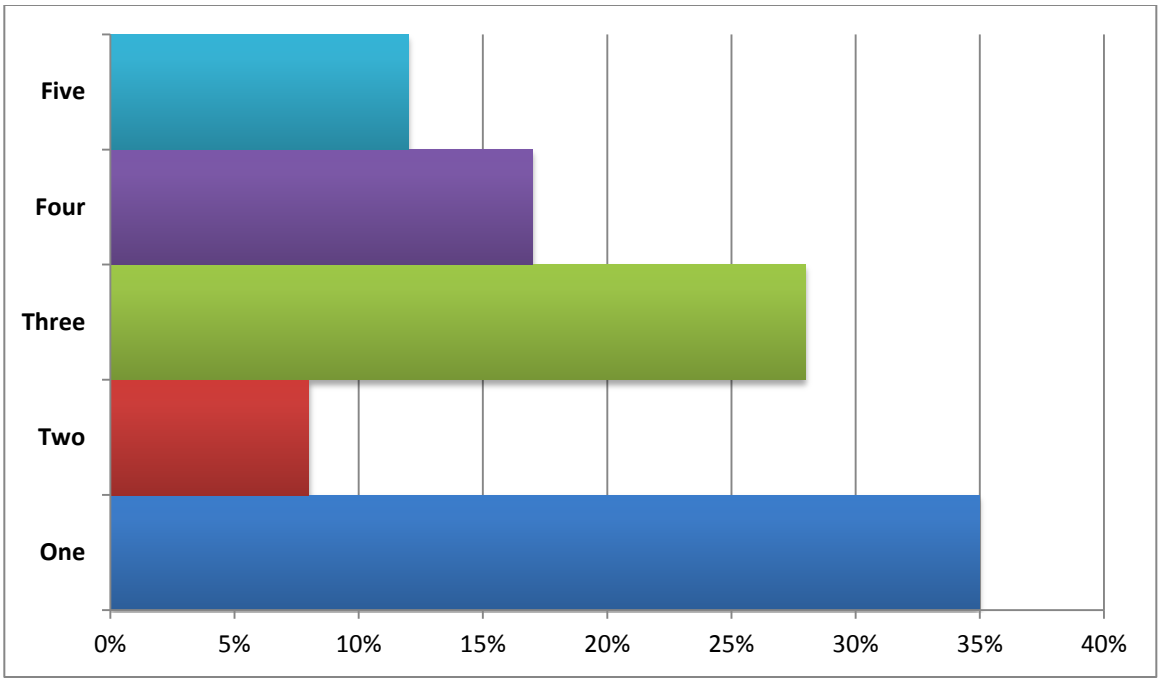

Figure 37: Weekly forecast value indicated by all respondents

Figure 38 displays the frequency of values given to monthly forecasts including: One 86%, Two 3%, Three 5%, Four 2%, Five 5% (*M* = 1.37). Monthly Forecast Value was non-normally distributed with a skewness of 2.76 (SE = .183) and highly leptokurtic at 6.501 (SE = .363). Similar to hourly forecasts, the vast majority of respondents did not find value in monthly forecasts.

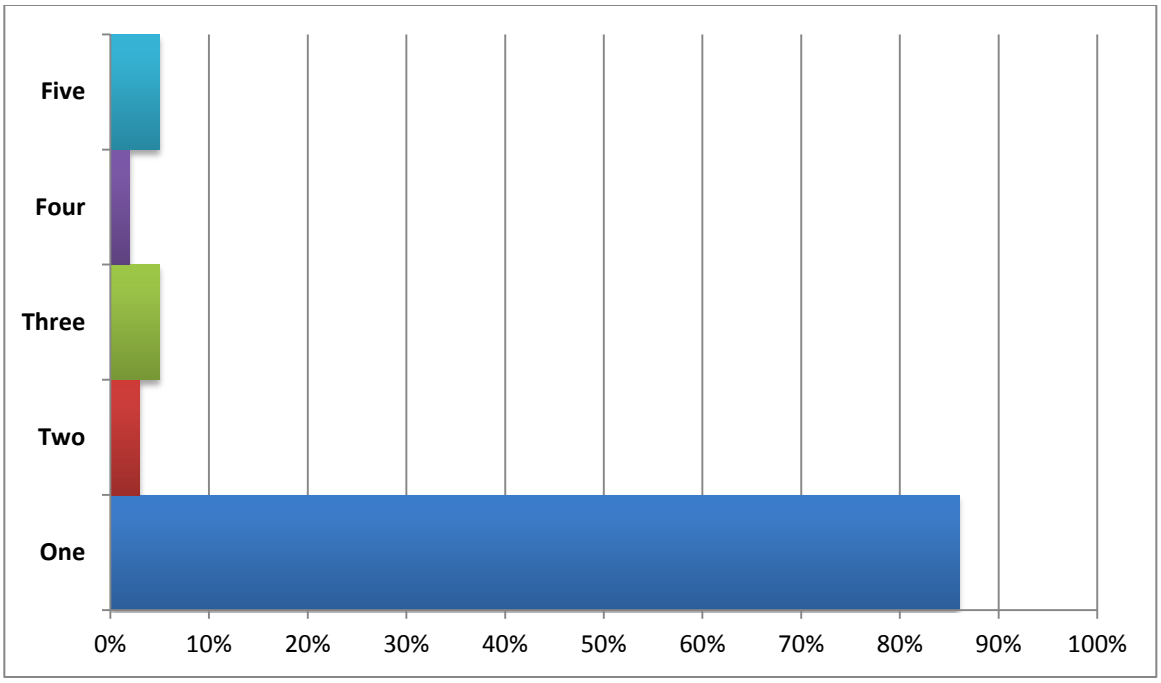

Figure 38: Monthly forecast value indicated by all respondents

Figure 39 displays the frequency of values given to seasonal forecasts including: One 88%, Two 2%, Three 3%, Four 3%, Five 4% (*M* = 1.34). Seasonal Forecast Value was non-normally distributed with a skewness of 2.83 (SE = .183) and highly leptokurtic at 6.774 (SE = .363). The vast majority of respondents did not find value in seasonal forecasts.

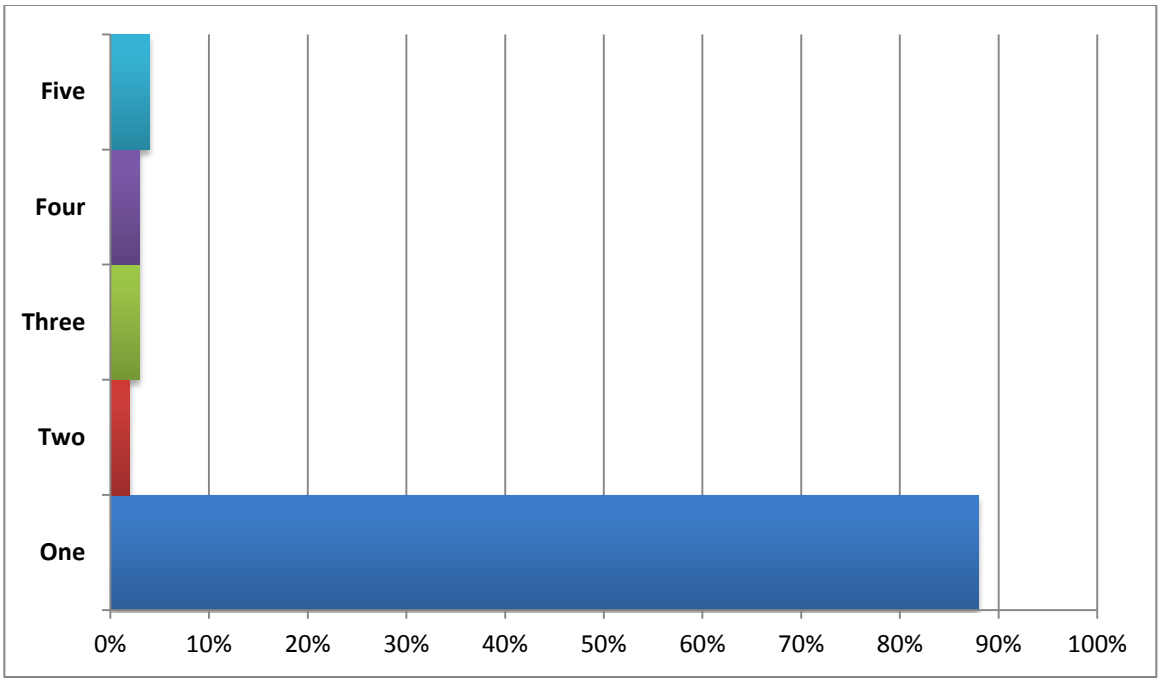

Figure 39: Seasonal forecast value indicated by all respondents

Figure 40 displays the frequency of values given to other forecasts including: One 92%, Two 2%, Three 3%, Four 3%, Five 4% (*M* = 1.21). Other Forecast Value was non-normally distributed with a skewness of 3.82 (SE = .183) and highly leptokurtic at 14.08 (SE = .363). Other forecasts did not hold much value for coastal tourism businesses.

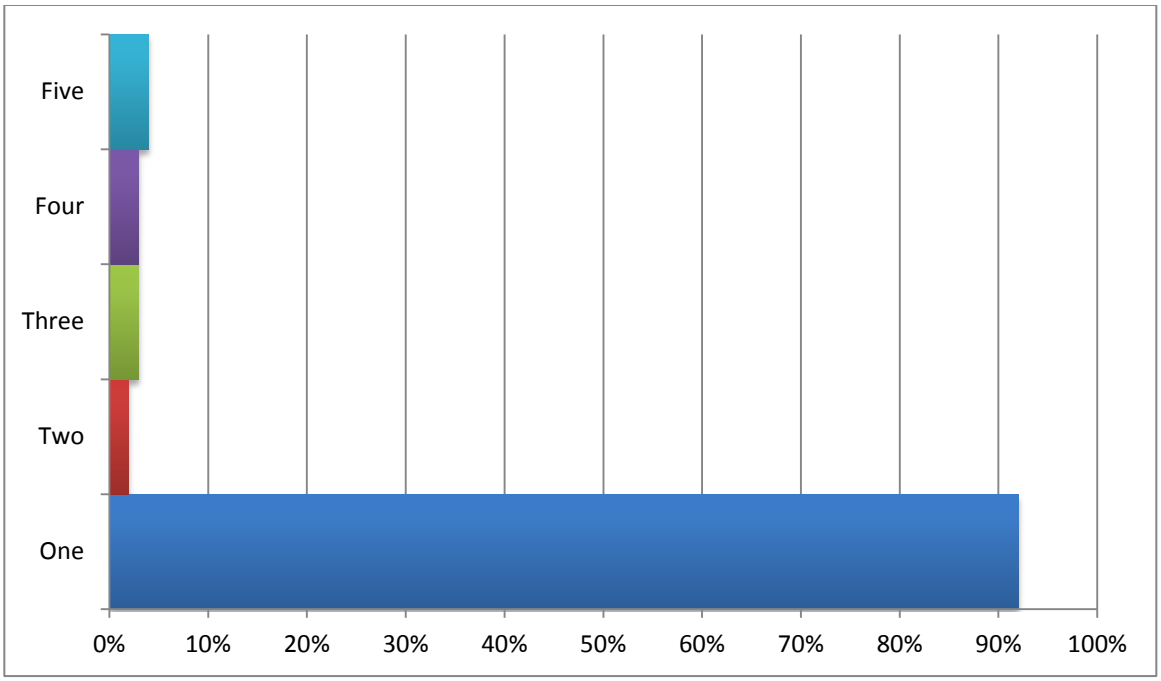

Figure 40: Other forecast value indicated by all respondents

On a scale from one to five with one being least valuable, respondents were asked to rank the value of a specific forecast compared to the other forecast temporal scales. Table 25 shows the average individual value score compared to the score when ranked or compared to the other forecast temporal scales. Examining the numbers, there is an increase in value when comparing individual forecast value to its comparative value. A 20-50% increase is realized and mean Daily and Weekly value switch ranks when considering comparative value (Table 25). The comparative ranking question asked for current as well as potential unrealized value for each forecast temporal scale, which probably explains the increase in percentage. This also suggests that there may be room for growth in forecast utility if the various concerns for not using the forecasts (reported earlier) can be adequately addressed.

Forecast Temporal Scale	Mean Individual Value	Mean Comparative Value	Percent Change
Weekly	2.64	3.23	22%
Daily	2.56	3.32	30%
Hourly	2.23	2.88	29%
Monthly	1.37	2.04	49%
Seasonal	1.34	1.92	43%
Other	1.21	1.82	50%

Table 25: Percent change from individual forecast value to its comparative value

4.2.2 Correlation and Principle Component Factor Analysis for Value

A correlation analysis was run between the dependent variables measuring forecast value (Table 26). Hourly forecast value had a high correlation (> 0.7) with daily forecast value and was significantly correlated with daily and weekly forecast value. Daily and weekly forecast value was significantly correlated with all forecast temporal scales except seasonal, and highly correlated (0.839 and 0.956 respectively) with Other value. Monthly value was highly correlated with Other value (-0.982) but did not reach significance. Seasonal forecast value was only significantly and highly correlated with Monthly value (0.973).

Value Correlations

		Hourly Forecast Value	Daily Forecast Value	Weekly Forecast Value	Monthly Forecast Value	Seasonal Forecast Value	Other Forecast Value
Hourly Forecast Value	Pearson Correlation	1	.727**	.500**	.194	-.396	.683
	Sig. (2-tailed)		.000	.000	.488	.379	.062
	N	94	74	73	15	7	8
Daily Forecast Value	Pearson Correlation	.727**	1	.622**	.567**	.360	.839**
	Sig. (2-tailed)	.000		.000	.005	.206	.005
	N	74	113	91	23	14	9
Weekly Forecast Value	Pearson Correlation	.500**	.622**	1	.582**	.383	.956**
	Sig. (2-tailed)	.000	.000		.002	.143	.000
	N	73	91	123	25	16	10
Monthly Forecast Value	Pearson Correlation	.194	.567**	.582**	1	.973**	-.982
	Sig. (2-tailed)	.488	.005	.002		.000	.121
	N	15	23	25	25	12	3
Seasonal Forecast Value	Pearson Correlation	-.396	.360	.383	.973**	1	-.923
	Sig. (2-tailed)	.379	.206	.143	.000		.077
	N	7	14	16	12	21	4

Other Forecast Value	Pearson Correlation	.683	.839**	.956**	-.982	-.923	1
	Sig. (2-tailed)	.062	.005	.000	.121	.077	
	N	8	9	10	3	4	16

Table 26: Correlations for variables measuring forecast Value
**. Correlation is significant at the 0.01 level.

Due to the high correlations in Table 26, principal components factor analysis using a 2-factor solution was then run. Other forecast value was not included in the factor analysis because it does not relate temporally to the other forecasts, thus it remains a separate forecast value type. Initial eigenvalues indicate that 72.16% of the variance in the five value items is explained by two components. A minimum factor loading score of .45 was required for an item to load onto a factor (Bian & ECU OFE 2013). A summary of factor loadings from the rotated component matrix is provided in Table 27. Factor 1 consists of short-range forecast value (hourly, daily and weekly). Factor 2 consists of long- range forecast value (monthly and seasonal).

	Component 1	Component 2
Hourly Forecast Value	.798	-.167
Daily Forecast Value	.860	.114
Weekly Forecast Value	.738	.240
Monthly Forecast Value	.201	.865
Seasonal Forecast Value	-.071	.891

Table 27: Factor loadings for rotated component matrix for forecast Value

Based on these results, two new variables were computed. A short-range forecast value variable (SRV) (α = .738) was created from the weighted average of hourly, daily and weekly forecast value. A long-range forecast value variable (LRV) (α = .738) was created from the weighted average of monthly and seasonal forecast value. Weak correlations between value variables, the scree plot and alpha levels indicate that these value variables can be used in MANVOA.

4.2.3 Correlation and Principle Component Factor Analysis for Forecast Usefulness

A correlation analysis was run between the dependent variables measuring forecast usefulness (Table 28). Hourly forecast usefulness was significantly correlated with daily forecast usefulness (.48) and weekly forecast usefulness (.30). Daily forecast usefulness was significantly correlated with weekly forecast usefulness (.66) and significantly correlated with monthly forecast usefulness (.47) and seasonal forecast usefulness (.35). Weekly forecast usefulness was significantly correlated with monthly forecast usefulness (.51) and significantly correlated with seasonal forecast usefulness (.42). Monthly forecast usefulness was significantly correlated with seasonal forecast usefulness (>.7). Seasonal forecast usefulness was significantly correlated with Other forecast use (< .3).

Correlations for Usefulness variables

		Hourly Forecast Usefulness	Daily Forecast Usefulness	Weekly Forecast Usefulness	Monthly Forecast Usefulness	Seasonal Forecast Usefulness	Other Forecast Usefulness
Hourly Forecast Usefulness	Pearson Correlation	1	.484**	.304**	-.002	-.023	.078
	Sig. (2-tailed)		.000	.000	.980	.755	.291

	N	186	186	186	186	186	186
Daily Forecast Usefulness	Pearson Correlation	.484**	1	.661**	.471**	.355**	.046
	Sig. (2-tailed)	.000		.000	.000	.000	.529
	N	186	186	186	186	186	186
Weekly Forecast Usefulness	Pearson Correlation	.304**	.661**	1	.511**	.424**	-.028
	Sig. (2-tailed)	.000	.000		.000	.000	.706
	N	186	186	186	186	186	186
Monthly Forecast Usefulness	Pearson Correlation	-.002	.471**	.511**	1	.779**	.082
	Sig. (2-tailed)	.980	.000	.000		.000	.267
	N	186	186	186	186	186	186
Seasonal Forecast Usefulness	Pearson Correlation	-.023	.355**	.424**	.779**	1	.155*
	Sig. (2-tailed)	.755	.000	.000	.000		.035
	N	186	186	186	186	186	186
Other Forecast Usefulness	Pearson Correlation	.078	.046	-.028	.082	.155*	1
	Sig. (2-tailed)	.291	.529	.706	.267	.035	
	N	186	186	186	186	186	186

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 28: Correlations for variables measuring forecast Usefulness

Monthly, seasonal and other forecast usefulness was very weakly correlated with hourly forecast usefulness. Daily, Weekly and monthly forecast usefulness was very weakly non-significantly correlated with other forecast usefulness. Most importantly, there were only seven nonsignificant items. Again because of the high correlations, a principle component factor analysis with a Varimax rotation was conducted to create new variables to measure usefulness. Other forecast usefulness was not included in the factor analysis since it is a very temporally different type of forecast from the others resulting in it remaining its own variable. A moderate KMO value of .671 suggests that we have a sufficient sample size relative to the number of items

in the scale. According to Bartlett's test ($p < .05$), the correlation matrix is not an identity matrix. The MSA statistics indicate that the correlations among the individual items are strong enough to suggest that the correlation matrix is factorable. The five communality values were highly above the significance threshold of .30 (UCLA: Statistical Consulting Group 2014). Eigenvalues greater than 1 were requested to be extracted resulting in two principal components comprising the extracted solution which was also supported by the scree plot. A principle components factor analysis using a 2-factor solution was then run. Initial eigenvalues indicate that 79.71% of the variance in the five value items is explained by two components. A minimum factor loading score of .45 was required for an item to load onto a factor. Weekly forecast usefulness exhibited double factor loading but was assigned to the component containing daily and weekly hourly forecast because it temporally relates more with short-range forecasts than monthly and seasonal (Bian & ECU OFE 2013). A summary of factor loadings from the rotated component matrix is provided in Table 29. Factor 1 consists of long-range forecast usefulness (monthly and seasonal). Component 2 consists of short-range forecast usefulness (hourly, daily and weekly).

	Component 1	Component 2
Daily Usefulness	-.193	.876
Hourly Usefulness	.419	.789
Weekly Usefulness	.555	.619
Monthly Usefulness	.923	.128
Seasonal Usefulness	.907	.028

Table 29: Factor loadings for rotated component matrix for forecast Usefulness

Based on these results, two new variables were computed.Monthly and seasonal forecast usefulness were averaged for a long-range forecast usefulness variable (LRU) (α = .876). Hourly, daily and weekly forecast usefulness were averaged for a short-range forecast usefulness variable (SRU) (α = .735). In general, usefulness variables are weakly correlated. However, SRU and LRU are correlated at 0.394 ($p < 0.05$). These conditions combined with the scree plot and the alpha levels indicate that these usefulness variables can be used in MANVOA.

4.3 Comparison Analysis

ANOVA is run three times to test whether the mean of perceived weather and climate dependency is different among i) the six categories of business types ii) the three categories of business age and iii) the two categories of business size. MANOVA is run three times to test whether the means of three variables: short-range forecast value, long-range forecast value, and other forecast value are different among i) business types ii) business age and iii) business size. This statistical test was repeated (run three more times) with forecast value variables being replaced by forecast usefulness variables. The significant results are presented first, followed by the null results. Business Type and Perceived Dependency

There is a statistically significant difference in levels of perceived climate and weather dependency based on business type determined by a one-way ANOVA $F(5, 171) = 10.785$; $p < .05$. A Tukey post-hoc test revealed that perceived climate and weather dependency was statistically significantly lower for Accommodations ($M = 3.15 \pm 1.5$, $p = .001$), Food Services ($M = 2.91 \pm 1.3$, $p = .000$) and Other ($M = 3.08 \pm 1.5$, $p = .016$) compared to Agriculture ($M =$

4.52 ± 1.0). Perceived climate and weather dependency of Outdoor Recreation (4.55 ± .80, p = .016) was statistically significantly higher than Accommodations (*M* = 3.15 ± 1.5, p = .00), Food Services (*M* = 2.91 ± 1.3, p = .00); Parks and Heritage (*M* = 3.29 ± 1.5, p = .026), and Other (*M* = 3.08 ± 1.5, p = .007). There were no statistically significant differences on perceived climate and weather dependency between the remaining business types (Table 30).

Variable	Groups	Mean	SD	F	Sig.
Perceived Climate and Weather Dependency	Agriculture[a]	4.52[cdf]	1.039	10.785	.050*
	Outdoor Recreation[b]	4.55[cdef]	.794		
	Accommodations[c]	3.15[ab]	1.509		
	Food Services[d]	2.91[ab]	1.260		
	Parks and Heritage[e]	3.29[b]	1.541		
	Other[f]	3.08[b]	1.541		

Table 30: Mean difference on perceived climate and weather dependency among business types. Significant differences among groups indicated by superscript letters a,b,c,d,e,f.

*Significant at the .050 level

The box plot below charts differences in perceived climate and weather dependency based on business type (Figure 41). Half of the respondents in all sectors indicated at least a level 2 of perceived climate and weather dependency. Perceived Dependency among Agriculture respondents (n = 23) ranged from 1 to 5 although only five of the scores were different from a value of 5 (three values of 2 and two values of 4). With an interquartile range from 2.73 to 3.76, Agriculture respondents exhibited an extremely high dependency on climate and weather information. The significant difference between Agriculture and Accommodations is linked to

the Accommodations median of 1.67, a range of 1 to 5, and an interquartile range from 1.66 to 2.29. The wider range of levels of perceived climate and weather dependency from Accommodations respondents differs from those in Outdoor Recreation whose median is 2.67 and an interquartile range is 2.32 to 3.25. Besides two outliers, Outdoor Recreation respondents indicated a level of 4 or 5 in perceived dependency on climate and weather. Accommodations and Food Services share a median of 2.0 and a range of 1 to 5. However, Accommodations exhibited a larger dispersion from the median with an interquartile range of 2.67 to 3.62. Food Services were not quite as dispersed with an interquartile range of 2.56 to 3.25. Other respondents had a lower median perceived climate and weather dependency of 3 than Agriculture. With a range of 1 to 5 and an interquartile range of 2.17 to 3.98, their responses were normally distributed but quite spread from the mean. Like Agriculture, Outdoor Recreation respondents indicated very high dependency on climate and weather information with a median value of 5, range of 2 to 5 and an interquartile range of 4.26 to 4.83. This differs from the much lower median and dispersed scores of Accommodations. Compared to Outdoor Recreation, Parks and Heritage respondents indicated a lower median level 3 of perceived climate and weather dependency with a wider range of scores from 2 to 5 and wider dispersion of perceived climate and weather dependency levels in an interquartile range of 2.40 to 4.18. Similar to its relationship with Agriculture, Other respondents indicated a lower median level of 3 in perceived climate and weather dependency as well as a larger range of scores from 2 to 5 and a wider dispersion of perceived climate and weather dependency levels in an interquartile range of 2.17 to 4.26 compared to Outdoor Recreation.

Outliers for Agriculture's perceived dependency are indicated as extreme outliers since most of these respondents indicated the highest level of perceived dependency. Out of five

Agriculture outliers, three indicated a level two of perceived dependency and included two marinas and a yacht retailer. The other two Agriculture outliers indicated a level four of perceived dependency and included a marina/boating community and a charter boat business. The diversity of revenue streams within the marina/boating community could provide a larger safety net from climate and weather impacts explaining their low perceived dependency on climate and weather. Outdoor Recreation had two extreme outliers indicating a level two of perceived dependency and included a youth summer camp and a laser tag facility. Since there were only three indoor recreation businesses within our sample, they were included into the general category of Outdoor Recreation. Their low perceived dependency is similar to other indoor businesses within Accommodations and Food Services.

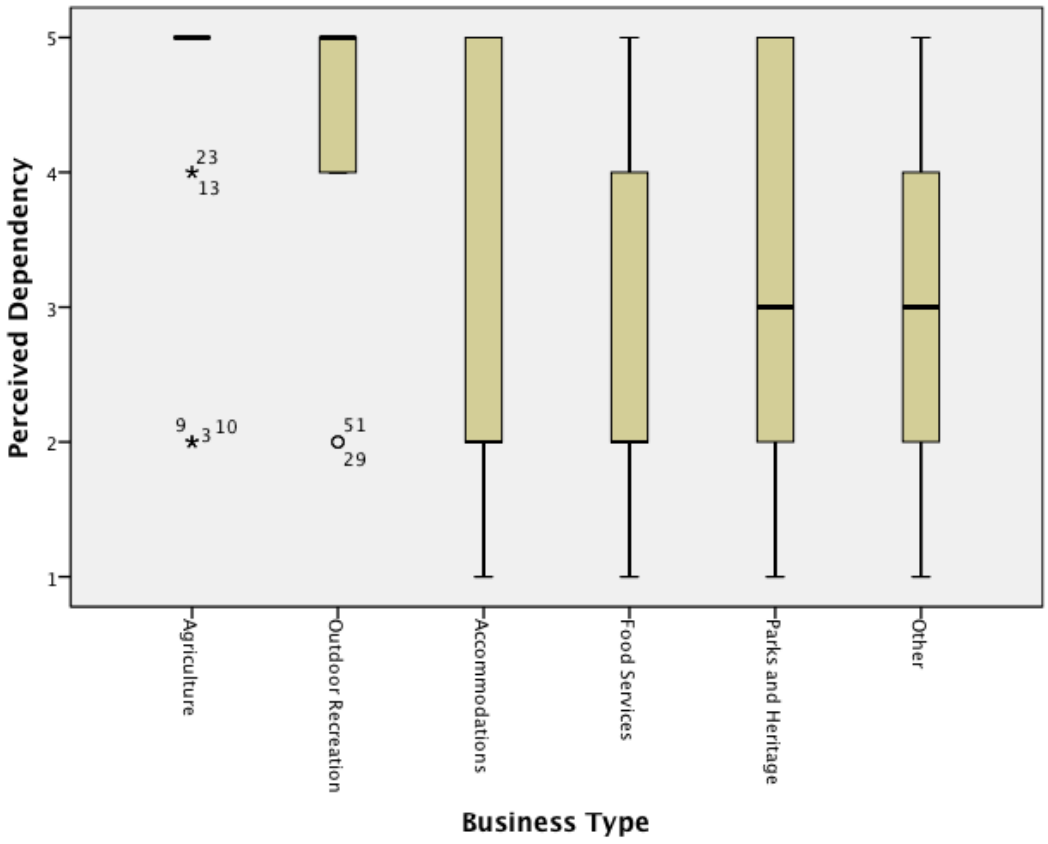

Figure 41: Differences in short-range Value based on business type

- Outlier

* Extreme Outlier

Business Type and Forecast Value

A significant Box's M test (p = .00) indicates unequal variance and sample size across groups meaning our MANOVA may not be robust. However, this should not be a problem since we have such high power (Carnegie Mellon 2009). A one-way MANOVA revealed a statistically significant difference in forecast value based on business type F (15, 466.436) = 1.996; p = .014; Wilk's λ = .842; partial η^2 = .056; power = .940. Given the significance of the overall test, the univariate interactions were examined. Significant univariate main effects for business types were obtained for short-range value F (5, 171) = 4.385; p = .001; partial η^2 = .114; power = .964. Short-range forecast value was statistically significantly higher for Agriculture (*M* = 3.17 + 1.0) than Accommodations (*M* = 1.98 + 1.0, p = .001). Short-range forecast value was also statistically significantly higher for Outdoor Recreation (*M* = 2.79 + 1.3) than Accommodations (*M* = 1.98 + 1.0, p = .034). There was no statistically significant difference between Business Type and Other Value (p = .254) or between Business Type and Long-Range Value (p = .710). For short-range value, there was no statistically significant difference between the remaining business types (Table 31).

Variable	Groups	Mean	SD	F	Sig.
Short-Range Forecast Value	Agriculture[a]	3.14[c]	1.039	4.385	.050*
	Outdoor Recreation[b]	2.79[c]	.794		
	Accommodations[c]	1.98[ab]	1.509		
	Food Services[d]	3.64	1.260		

	Parks and Heritage[e]	2.83	1.541		
	Other[f]	2.10	1.541		

Table 31: Mean difference on perceived climate and weather dependency among business types. Significant differences among groups indicated by superscript letters a,b,c,d,e,f.

*Significant at the .050 level

The box plot below charts differences in short-range value based on business type (Figure 42). With Accommodations (n = 41) accounting for twice as many respondents as Agriculture (n = 23), their significant mean differences are salient with a median short-range forecast value of 3 for Agriculture being almost twice the median value of 1.67 for Accommodations. Agriculture short-range forecast value ranged from 1 to 5 although the short-range forecast value of 1 was an outlier. Half of Agriculture short-range forecast values fell within the interquartile range of 2.73 to 3.62 indicating minimal dispersion from the mean. Accommodations short-range forecast value ranged from 1 to 5 although two outliers comprise the highest scores of 4 and for all chosen values. Half of Accommodations short-range forecast values fell within the interquartile range of 1.66 to 2.29 indicating minimal dispersion from the mean.

Outdoor Recreation's (n = 33) median (2.67) was 1.6 times greater than the median of Accommodations (1.67) thus making their significant differences apparent. Outdoor Recreation short-range forecast value ranged from 1 to 5 with half of its scores falling within the interquartile range of 2.32 to 3.25 indicating a larger spread of short-range forecast value than the lower-value interquartile range of Accommodations.

Agriculture, Accommodations, Food Services, and Other had a total of nine outliers. Interestingly, the same agriculture business indicating a low perceived dependency also indicated

a very low value on short-range forecasts. The two outliers for Accommodations included a waterfront property contractor and a realty company indicating high value on short-range forecasts. The five outliers for Food Services included two waterfront restaurants, two grills and one general restaurant that indicated high value of short-range forecasts. Perhaps the proximity of a restaurant to the water means increase risk from flooding and waves from adverse weather conditions that could be minimized by using short-range forecasts. An outdoor recreation guide and outfitter business indicated the highest value of short-range forecasts in the Other category, which is consistent with businesses in the Outdoor Recreation sector.

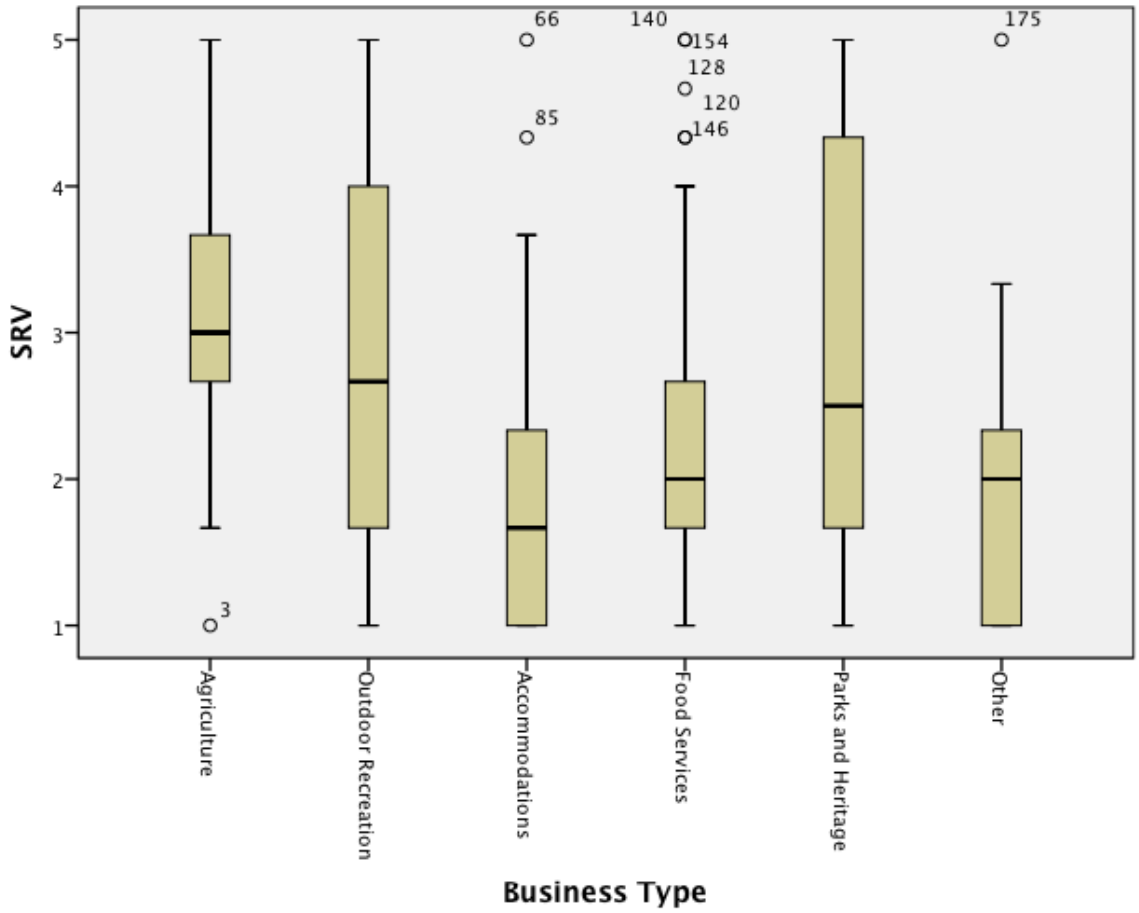

Figure 42: Differences in short-range Value based on business type

- ∘ Outlier
- * Extreme Outlier

Business Type and Forecast Usefulness

A significant Box's M (p = .00) indicates unequal variance and sample size across groups. A one-way MANOVA revealed no statistically significant difference in forecast usefulness based on business type F (15, 466.936) = 1.299; p = .198; Wilk's λ = .893; partial η^2 = .037; power .760.

Business Age and Forecast Value

A significant Box's M test (p = .025) indicates unequal variance and sample size across groups. A one-way MANOVA revealed no statistically significant difference in forecast value based on business age F (6, 344) = .413; p = .870; Wilk's λ = .986, partial η^2 = .01; power = .760.

Business Age and Usefulness

A significant Box's M (p = .00) indicates unequal variance and sample size across groups. A one-way MANOVA revealed no statistically significant difference in forecast usefulness based on business age F (6, 344) = .344; p = .919; Wilk's λ = .988; partial η^2 = .01; power = .144.

Business Age and Perceived Dependency

There is a non-significant difference between business age and perceived dependency as determined by a one-way ANOVA F (2, 174) = 2.492; p = .086.

Business Size and Value

A non-significant Box' M test (p = .083) indicates equal variance and sample size across groups. A one-way MANOVA revealed no statistically significant difference in forecast value based on business size F (3, 173); p = .368; Wilk's λ = .982; partial η^2 = .018; power = .284.

Business Size and Usefulness

A significant Box's M (p = .00) indicates unequal variance and sample size across groups. A one-way MANOVA revealed no statistically significant difference in forecast usefulness based on business size F (3, 173) = .641; p = .589; Wilk's λ = .989; partial η^2 = .011; power = .183.

Business Size and Perceived Dependency

There is a non-significant difference between groups as determined by one-way ANOVA F (2, 174) = 1.150; p = .319.

Table 32 is a general user profile for each business type created from the above analysis.

	USER PROFILE								
	Average Education Level	**Average Business Size**	**Average Business Age**	**Average Perceived Dependency**	**Most Useful Forecast**	**Most Popular Use of This Forecast Type**	**Least Useful Forecast**	**Most Valuable Forecast**	**Least Valuable Forecast**
Agriculture	4-Years of College	Small Business	Middle-Aged	Very Dependent	Weekly	Operational Decision-Making & Risk Management	Seasonal	Daily	Seasonal
Outdoor Recreation	Some College/No Degree	Small Business	Middle-Aged	Very Dependent	Daily and Weekly	Operational Decision-Making	Seasonal	Daily	Seasonal
Food Services	Some College/No Degree	Small Business	Middle-Aged	Not Sure	Weekly	Operational Decision-Making	Seasonal	Weekly	Monthly
Parks and Heritage	Post-Graduate	Small Business	Middle-Aged	Not Sure	Weekly	Operational Decision-Making & Risk Management	Seasonal	Daily	Seasonal
Accommodations	Some College/No Degree	Small Business	Middle-Aged	Not Sure	Weekly	Operational Decision-Making	Monthly	Weekly	Seasonal
Other	Some College/No Degree	Small Business	Old	Not Sure	Weekly	Risk Management	Monthly	Weekly	Monthly and Seasonal

Table 28: A general climate and weather information user profile for each business type

By taking the average of each descriptive statistics, a general user profile was created for each business type. On average, all respondents had at least completed some education above high school. Small, middle-aged businesses were the average business represented. On average, outdoor-oriented businesses found themselves very dependent on climate and weather while all other business types were not sure of their dependency on climate and weather. Weekly forecasts were the most frequently used forecasts with Operational-Decision Making and Risk Management being the two most popular uses of Weekly forecasts. Short-range forecasts were the most valuable forecasts. Long-range forecasts were the least useful and least valuable.

5. Discussion

The purpose of this project was to determine the weather and climate sensitivity of coastal tourism businesses and learn how they use climate and weather forecasts for decision making. Interestingly, there was a difference among business type to their perceived dependence. From an ANOVA analysis, Food Services behaved similarly to Accommodations in that the Perceived Climate and Weather Dependency is much lower than Agriculture and Outdoor Recreation. This could indicate a divide between indoor and outdoor tourism businesses. Accommodations and Food Services could be classified as indoor-oriented businesses because of their similarities. Out of twenty-five Agriculture businesses, one business had originally identified their operations as a bed and breakfast and farm as Crop Production. The other twenty-two businesses were comprised of charter boats, marinas, yacht clubs and a pier. Outdoor Recreation contained a wide range of businesses including country clubs; festivals; outdoor drama theatre; golf courses; campgrounds; riverboat, dolphin and wild horse tours. Three out of thirty-six businesses from the original category of Amusement and Recreation were actually indoor businesses that included: a bowling alley, an arcade, and a laser tag facility. These three businesses might have marginally exaggerated the total percentage of Outdoor Recreation businesses. Despite being the only three indoor businesses outside of Food Services and Accommodations in our sample, they represent other sectors within indoor businesses with which outdoor businesses could partner.

The reason for Parks and Heritage businesses having significantly lower Perceived Dependency on climate and weather information could be because respondents in this category represent a state/federal funded operation that operates for the most part, rain or shine year-round. This thinking could be reversed as outside forces such as government shutdowns or

unprecedented extreme weather events such as Hurricane Sandy shut down park and cultural sites to a critical point of decreased visitor spending. For instance, during the 2013 government shutdown, some states signed agreements to fund the opening of certain national parks, as was the case of Utah that funded the opening of all eight of its national parks at the daily cost of $166,572 for a six-day period. The importance of visitor spending was seen with the estimated 25,000 people per day visiting one of Utah's national parks generating about $1.67 million in NPS-related visitor spending during that six-day period (National Park Service 2013). With a likely increased frequency of these complex situations, this stakeholder might realize a greater dependency on climate and weather, and thus a greater use of climate and weather information.

5.1 Short range forecasts

Hourly forecasts were the third most used forecasts and were primarily used for Operational Decision-Making and Risk Management. Operational Decision-Making was represented by seven out of eleven open-ended response. Risk Management was represented by three out of eleven open-ended responses thus supporting their position as the two primary uses of hourly forecasts. Hourly forecasts provide real-time relatively accurate data with which businesses feel they can safely make low-risk immediate decisions explaining the popularity of Operational Decision-Making and Risk Management. Agriculture used Hourly forecasts for both long-range (Finance and Budgeting) and short-range (Operational Decision-Making and Risk Management) decisions. This wide range of uses could reflect their high perceived dependency on climate and weather. Interestingly, Accommodations used this short-range forecast for long-range decisions (Marketing, Investment Decisions, Landscaping). Perhaps this was selected as a forecast used during a landscaping project as opposed to planning for one at a new resort. The marketing strategies may be short-term such as a hotel partnering with the aquarium to send their

patrons at a discounted price during adverse weather. The unimportance to the business was the most frequently indicated reason for not using hourly forecasts, particularly by Accommodations by 74% of its respondents not using Hourly forecasts. This is not surprising however with their heavier use on long-range forecasts due to the nature of reservations in some NC coastal areas occurring many months out. Accommodations indicated an uncertainty about its dependency on climate and weather that could affect the importance it places on climate and weather information. Themes emerging from the open-ended responses for non-use of Hourly forecasts include: useful in adverse weather conditions, the lead-time not being long enough to alter plans and not enough detail in these forecasts. The need for more detail was seen across all forecast open-ended non-use responses. An example of low detail could be a daily forecast on a local news station with a rain cloud and a 30% probability of rain from 10am-2pm. The confusion may lie in whether that means 30% of the viewing area will receive rain or that it will rain for twenty minutes per hour. Also the need for detail may relate to the need for overall interpretation of how the forecast will affect their specific tourism operation. Open-ended responses revealed hourly and daily forecasts being used for guest information, which is supported by Gomez (2005) who identifies tourists as another important consumer of climate and weather information. While our forecasts included temperature and precipitation forecasts, open-ended responses might have revealed a user-slant towards precipitation forecasts in general with the mention of responding to stormy weather.

Daily forecasts were the second most used forecasts and were primarily used for Operational Decision-Making and Risk Management. Ten of out eleven open-ended responses fell underneath Operational Decision-Making supporting its role as a primary use of Daily forecasts. As with Hourly forecasts, Daily forecasts provide detailed relatively accurate data with

which businesses feel they can safely make low-risk immediate decisions explaining the popularity of Operational Decision-Making and Risk Management. Food Services used Daily forecasts for the primary purpose of Operational Decision-Making. This could include cutting or increasing staff for the day, hosting outside events or even whether to breakdown outside eating areas in the case of an adverse weather event. Agriculture used Daily forecasts for the primary purpose of Risk Management. Charter boats are one business of this sector that might use Daily forecasts to help determine if the weather conditions are safe enough to take fishers out on the boat. Outdoor Recreation used Daily forecasts primarily for Finance and Budgeting. Perhaps keeping track of sales using historical daily forecast data could help predict future sales for a given daily forecast. Themes emerging from open-ended responses for non-use of a daily forecast include: low accuracy, lead-time not being long enough to alter plans and not enough detail. The fact that inaccuracy was a problem for Daily forecasts and not for Hourly and Weekly might relate to problem with detail. A general daily forecast of partly sunny could leave respondents wondering how much of the day the sun will be out. Since chances of sunshine are not given in percentages, rather relative descriptions, users will have differing expectations based on their subjective interpretation of what a sunny day looks like. A better use of cloud cover predictions could help develop a likelihood scale for sunshine or cloud cover. The importance of sun to coastal destinations lies within the overall perceived image of a coastal destination particularly in the summer and also relates to many outdoor activities in the area from tanning on the beach to visiting historical sites. Overall, Accommodations, Food Services, and Parks and Heritage placed little value on short-range forecasts. This indicated unimportance could relate to the uncertainty of these three business sectors about their dependency on climate and weather. Perhaps these three business types use climate and weather out of habit and do not realize the

extent of their use thus distorting the actual integration of climate and weather in various aspects of the business.

Weekly forecasts were used the most and primarily for Operational Decision-Making followed by Risk Management. The Weekly forecast use profile shifts a little towards long-term decision making with Finance and Budgeting and Marketing comprising a larger share of uses than with Hourly and Daily forecasts. A large proportion of agriculture businesses use weekly forecasts for Investment Decisions and Sustainability. In fact, the portfolio of uses is quite diverse, which relates to the strong perceived dependence agriculture has on weather and climate. Fourteen open-ended responses revealed tourists using this temporal scale of forecast the most in their planning (five respondents) revealing the most difficult planning obstacle for business owners and managers. Nine responses fell underneath Operational Decision-Making supporting its role as a lead use of Weekly forecasts. Two responses refer to Finance and Budgeting supporting the idea that Weekly Forecast represents a set of users who make a mix of short and long-term decisions. This could mean that they do not need as much help in figuring out how to use climate and weather information for their planning purposes. The unimportance to the business and other reasons were the most frequently indicated reasons for not using Weekly forecasts. Weekly and Daily forecasts share a similar non-use profile meaning that respondents may see similar problems with these forecasts. Therefore, open-ended responses for non-use of Weekly forecasts were examined and emerging themes included: unreliability and not enough detail.

Responses to hourly, daily, and weekly forecasts were highly related and so were combined into a short-range forecast index to measure usefulness and value. This index was input into a MANOVA analysis to determine factors that may predict whether a business would

use and/or value short range forecasts. Similar to perceived dependence, Agriculture and Outdoor Recreation both place a statistically significant greater value on short range forecasts than Accommodations. Gamble and Leonard (2005) suggest that outdoor-oriented tourism activities find climate and weather information vitally important. As mentioned earlier, forecast Usefulness and Value are thought to relate. Usefulness was measured by how many times or ways a forecast is used, thus predisposing short-range forecasts to be ranked as more useful than long-range or other forecasts.

5.2 Long-range forecasts

An obvious shift towards long-range planning is seen in Monthly Forecasts with Marketing and Finance and Budgeting as the two most popular uses. Like Monthly forecasts, Marketing and Finance and Budgeting are the two most popular uses of Seasonal forecasts. However, these high-risk uses may be augmented by other forecasts such as average profit margin. Also, the raw historical data used in creating these forecasts can be obtained for businesses to make their own projections about monthly and seasonal climate and weather conditions. Forecasts regardless of weather or financial, assume the same risk of error or decreased accuracy. Tourism business owners using this information are likely to understand this relationship and can interpret the meaning of a long-range weather forecast with the same caution as a financial one. Other business types used Monthly forecasts for Investment Decisions and Finance and Budgeting. This sector included event-planning businesses for which Monthly forecasts could aid in adjusting budgets according to predicted event cancellations or extra-incurred costs due to adverse weather conditions. Long-range forecast users may also use these forecasts to guide their short-range forecast use. For instance, a projected abnormally wet summer might direct coastal tourism business owners to focus more on weekly forecasts in that

summer. Unimportance to the business was the most frequently indicated reason for not using Monthly forecasts by all business sectors except Agriculture and Other sectors who chose Other Reasons for not using Seasonal forecasts. Accommodations indicated unimportance of Monthly forecasts although it was the number one user of long-range Seasonal forecasts primarily for Marketing. This would make sense to market at least a season out since most reservations will occur at least that far in advance. In this case, perceived dependency could relate to the actual frequency with which climate and weather information is used. Seasonal forecasts are the only forecasts that might be used for Investment Decisions, which supports the idea that high-risk decisions require more uncertain and long-range data including climate and weather. According to our data, seasonal forecasts are not very useful or valuable to our respondents with Unimportance being the number one reason by all sectors except for Agriculture and Other sectors that chose Other Reasons for not using Seasonal forecasts. However, this should be placed in the context of the decisions that are being made with these forecasts. Usefulness and value seem to directly correlate meaning the less Seasonal forecasts are used, the less valuable they will appear to be in the data. Uncertainty in forecast usefulness increases with forecast temporal scale. This seems to directly relate to the level of confidence in a forecast, which could translate into use. To increase confidence in and subsequent use of long-range forecasts, climate and weather information producers must simultaneously increase accuracy to decrease uncertainty and educate end-users on how to actually use this information for their specific needs. Themes emerging for non-use of Monthly forecasts include inaccuracy, unreliability and not enough detail. Themes emerging for non-use of Seasonal forecasts include: inaccuracy, unreliability, not enough detail and the thought of seasons being relatively stable in the area. In the face of climate change, the last theme may become less and less viable in the coming years.

5.3 Other forecasts

These non-traditional forecasts were rarely used, with Risk Management being the primary use. This application of Other forecasts could refer to hurricane forecasts for hurricane preparedness as mentioned in open-ended responses. Although it may seem counter-intuitive to make high-risk decision using less uncertain data, their temporal similarities validate their relationship.

5.4 Null results

Business age and size of business did not have an impact on forecast value, usefulness and perceived climate and weather dependency. The reason that age might not have been a factor could be because it does not take long to get an idea of a location's climate and weather when relocating to coastal North Carolina. Furthermore, business owners are most likely well-versed on the geography of the area including climate and weather beforehand meaning usefulness, value and perceived dependency are probably established early in a businesses' existence. With only two business sizes, it is no surprise that business size had no impact on a forecast's usefulness, value and perceived dependency in our study area. While no statistically significant mean differences exist on usefulness between business types, raw usefulness scores for each business type further highlights the alliance of short-range forecasts being valued and used more by outdoor-oriented businesses. Although Accommodations and Food Services indicated short-range forecasts as less important, they are still generally used, mostly for Operational Decision-Making and Marketing purposes. These contradictions, a comment that "people eat rain or shine", and a statistically significantly lower perceived climate and weather dependency for these indoor-oriented businesses than outdoor-oriented businesses suggests that

they may be unaware of the extent that climate and weather relates to their business, at least indirectly. As mentioned in the introduction, positive relationships can be formed between weather-sensitive outdoor recreational activities and indoor activities. Seasonal climatic information can help with the planning, scheduling and promotion of alternative indoor activities when weather conditions are not conducive to outdoor activities and vice-versa (Perry 1972). Sustainability was one of the least popular uses of all forecasts, and the reason could be due to the confusion of the definition. Although Matzarakis and Freitas (2001) propose landscaping as a possible use of climate and weather data, it was not a popular use of any of our forecasts. Interestingly, Sustainability and Landscaping decisions were informed by the weekly forecasts in less than 5% of respondents across all sectors, with the exception of agriculture, where percentages reached 20%. Overall, agriculture had a more diverse set of uses for climate and weather information.

It was thought that alternate sources of climate and weather data would entail wind, flora and fauna as forecast indicators (Roncolli 2009). Not finding this in open-ended answers could be due to the quantitative nature of our study. Qualitative research methods such as interviews might uncover this type of information.

Technical language is a suggested barrier to forecast use (Ziervogel and Downing 2004). However, our sample did not support this finding, and most respondents were aware of all the forecasts available to them. Our sample seems to be climate and weather savvy in some form or another. While a business type may only use two types of forecasts, they seem to be familiar with their forecast options. The key is reaching the business types who are unsure of their climate and weather dependency. This uninformed stakeholder holds much potential for outreach from government and private sector producers of climate and weather information.

5.5 Sustainability Implications

A majority of our respondents represented small locally owned businesses meaning that the multiplier effect is huge and beneficial to the local economy. However, these businesses thrive by being provided tools in which to operate effectively and efficiently to cut down on costs and minimize risk whether it be physical or financial. Although climate and weather are woven into the fabric of these counties' environments, its residents, in this case the tourism business owners still need accurate and reliable information about this aspect of their life so that they can capitalize on its financial opportunities and combat the negative effects it may bring. Achieving this will contribute to the financial sustainability of these businesses and the local economy in our study area.

Our sample used a variety of forecasts outside of just precipitation and temperature. Almost all of the forecasts respondents indicated using could be used for individual business sustainability purposes. The possibility of wind energy farms off of the North Carolina coast presents the possibility of change in business owners' energy consumption patterns depending on how much of their energy would be provided by these farms. While sunshine forecast use was not specifically mentioned, providing end-users with an accurate cloud-cover forecast (i.e. 30% cloud cover today) could encourage business owners to invest in solar panels since energy and financial savings can be forecasted with a little more accuracy.

6. Limitations

The small proportion of Microbusinesses may not be very representative of the actual number in our study area since chamber of commerce business directories may not be updated as quickly as

Microbusinesses come and go. Furthermore, Microbusinesses may not report themselves as a business if they're family-owned or more informal such as a from-home operation.

Although websites and local news are the two greatest ways to communicate climate and weather information, it is important to consider smartphones as valid means of information whose quality should be maintained. Respondents who selected the source of National Weather Service (NWS) might have been referring to accessing the NWS website meaning there is probably a greater percentage of website users than our data shows. While examining open-ended responses, some respondents may not have known the difference between NOAA and its branch of the NWS.

7. Future Research

This study did not specifically study the use of temperature vs. precipitation forecasts but rather generally examined them. More in-depth studies could be made on the usefulness and value between these weather conditions.

Marketing is a very broad category that contains ambiguity of which marketing strategies businesses develop with each temporal scale of forecast. With its popularity among monthly and seasonal forecast users, it is worth investigating what these strategies might be.

It might be important to think of the magnitude of decisions being made with these forecasts. Investment decisions have long-term implications and could affect all other facets of a business i.e. Operational Decision-Making or Finance and Budgeting. Therefore, it may be worth investigating the use of seasonal forecast for investment decisions of tourism businesses. Awareness of climate change will increase as its impacts are more frequently felt, thus making traditional seasonal climates uncertain and could increase interest in seasonal forecasts.

Because of the confusion of the definition of sustainability, a specific study into the sustainable initiative being taken by NC coastal tourism businesses and their relationship with climate and weather could be conducted.

Studying the impact of climate and weather on state and federal parks and cultural heritage sites might be helpful in tracking their use of climate and weather information. Further research could go into the relationship between forecast Accuracy, Value and Usefulness.

Choosing a study area with equal representation of different business types could be used to better study the relationship between business size and climate and weather.

A study by Lazo et al. (2009) surveyed US residents' perceived monetary value of the weather forecasts produced by private and public meteorology groups. The same method could be applied to our sample or the greater tourism industry.

Qualitative research methods such as interviews would complement the quantitative piece in this study to uncover alternative environmental indicators that may be used for forecasting by communities that are very aware of climate and weather in their area.

Forecast usefulness could have been skewed by the seasonal nature of tourism businesses. We did not ask respondents about the times of year in which they use different forecasts. Administering the survey at different times of the year or replicating this survey with a seasonality measure might affect respondents' answers.

8. Conclusions

The first research question of this study investigated what types of forecasts do tourism business owners use the most and for what purposes. Weekly forecasts were used the most for

Operational Decision-Making primarily by Food Services, contain the most diverse set of uses, and are the strongest threat to business owners of customers canceling plans. A better pairing of hourly and daily forecasts with weekly forecasts would provide a better picture of conditions for tourists' planning purposes and an opportunity for business owners and managers to create a positive relationship between outdoor and indoor actives to offer a better product to their customers (Perry 1972). If businesses contextualize themselves into broader categories of indoor and outdoor businesses, they could form strategic partnerships with other businesses to counteract potential negative climate and weather impacts by sharing customers.

It makes sense for short-range forecasts to see the most usage since everyday business operations will find the most relevance in them. However, the low value and usage of long-range forecasts should be contextualized by the frequency and magnitude of the types of decisions being made with these forecasts. Decision such as Investment and Marketing contain financial risk that must be addressed with more planning time and a wider range of resources, hourly to seasonal forecasts, in order to make informed and sound decisions for the business. The relationship between Usefulness and Value becomes more distorted as forecast lead times increase. Therefore, other indicators should be included to measure the true Usefulness and Value of long-range forecasts.

The use of Other forecasts such as wind and wave reports reflects the wide range of types of climate and weather information being used by this sector thus supporting the investigation into developing resources targeted for the needs of this stakeholder.

The second research question of this study investigated what types of forecasts do tourism business owners use the least and why. Seasonal forecasts were the least used forecasts

with non-importance/irrelevance being the primary reason for not using seasonal forecasts. Food Services were the lowest users of Seasonal forecasts.

The third research question of this study investigated what factors influence tourism business owners' decisions to use or not use a forecast. Many factors that have been reported to influence the use and value of weather and climate forecasts were not observed in this study. Business type did not have a statistically significant impact on forecast usefulness. Business age did not have a statistically significant impact on forecast value, usefulness and perceived dependency on climate and weather. Business Size did not have a statistically significant impact on forecast value, usefulness and perceived dependency on climate and weather.

The use of a forecast seems to be partly predicted by usefulness, value and relevance/importance to the business. Other factors that seem to impact forecast use include: perceived dependency on climate and weather, forecast accuracy, forecast reliability, and a lack of detail in forecasts.

The third research question also investigated specifically the impacts of business age, business size, and business type have on forecast use, forecast value and perceived dependency on climate and weather. Business Type impacted perceived dependency on climate and weather and revealed Agriculture being statistically significantly more dependent on climate and weather than Accommodations, Food Services and Other. Outdoor Recreation was statistically significantly more dependent on climate and weather than Accommodations, Food Services and Parks and Heritage. Business Type also impacted forecast Value particularly for short-range forecasts. Short-range forecast value was statistically significantly higher for Agriculture than Accommodations. Short-range forecast value was statistically significantly higher for Outdoor Recreation than Accommodations. In this study the Agriculture type was primarily businesses

that rely on the water (fishing). Weather cannot only decrease profits for these businesses, but can potentially harm life and property.

The fourth research question asked about other tools coastal tourism business owners use as alternatives to weather and climate forecasts. While respondents indicated that they use other types of forecasts such as wind and wave forecasts, the quantitative approach to this study did not provide much of an opportunity to discover uses of alternative environmental indicators outside of traditional weather and climate forecasts that might have been obtained through a qualitative component.

This study provides a novel profile of this large, diverse and sophisticated stakeholder, which is the tourism industry. According to the World Travel and Tourism Council's 2014 Travel and Tourism World Economic report, 2013 ended with the global tourism industry supporting 8.7% (265,855,000 jobs) of world employment including jobs indirectly supported by this industry. It is projected to rise to 10.2% by 2024. Additionally, the direct contribution of travel and tourism to the global GDP in 2013 was 2.9% and is projected to rise to 3.1% over the next decade (WTTC 2014). Many parts of the world's economy, including the US, depend upon or are impacted by the tourism industry's financial success. The coastal tourism sector of this industry is large and faces a triple threat of climate change, over development and in many cases, low sustainability standards. Therefore, it is crucial to provide reliable, accurate and relevant resources for the climate and weather-sensitive portions of this stakeholder in order to guide them in capitalizing on current climate and weather conditions and to prepare them for their potential changes.

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APPENDIX A

EAST CAROLINA UNIVERSITY
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600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** · **www.ecu.edu/irb**

Notification of Exempt Certification

From: Social/Behavioral IRB

To: Emily Ayscue

CC:
Scott Curtis

Date: 9/3/2013

Re: UMCIRB 13-001493
Climate and Weather Forecast Use among NC Coastal Tourism Businesses

I am pleased to inform you that your research submission has been certified as exempt on 9/3/2013. This study is eligible for Exempt Certification under category #2.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

The UMCIRB office will hold your exemption application for a period of five years from the date of this letter. If you wish to continue this protocol beyond this period, you will need to submit an Exemption

Certification request at least 30 days before the end of the five year period.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

APPENDIX B

RECRUITMENT TEXT

Dear (name inserted here),

My name is Emily Ayscue and I am a graduate student from the Center for Sustainable Tourism at ECU. Coastal tourism businesses are an important stakeholder in the production and dissemination of climate and weather information. In an effort to understand your businesses' climate and weather information uses and needs, I have created a short survey whose results will be offered to various climate and weather forecast producers such as The National Weather Service and the State Climate Office of North Carolina. Responses are confidential and participation voluntary. The survey should take no longer than 10 minutes. I have inserted the survey link below. We greatly value your opinion and appreciate your time. If you have any questions or know of anyone else who would be interested in taking the survey, please email me at **ayscuee08@students.ecu.edu**.

Thank You,

(survey link here)

APPENDIX C

SURVEY

Q35 What is the name of the business you represent?

Q36 How long have you been in business?

Q2 What is your position in the company?

Q3 Please indicate which type of business you represent.

- ❍ Crop Production (1)
- ❍ Breweries and Wineries (2)
- ❍ Fishing, Hunting, Trapping (3)
- ❍ Amusement and Recreation (4)
- ❍ RV Parks and Recreational Camps (5)
- ❍ Spectator Sports (6)
- ❍ Scenic and Sightseeing Transportation (7)
- ❍ Store Retailer (8)
- ❍ Travel Arrangements and Reservations (9)
- ❍ Accommodations (10)
- ❍ Food Services and Bars (11)
- ❍ Diving (12)
- ❍ Other (13) _____

Q4 Businesses who find climate and weather forecasts useful in decision-making could be considered climate and weather dependent. Based on this explanation, to what extent would you consider your business as weather and climate dependent?

- ❍ Not Dependent (1)
- ❍ Somewhat Dependent (2)
- ❍ Not Sure (3)
- ❍ Dependent (4)
- ❍ Very Dependent (5)

Q37 Where do you get your climate and weather information for making decisions for your business?

- ❑ A Private Company (such as The Weather Channel) app on a smartphone (1)
- ❑ A Private Company (such as The Weather Channel) website (2)
- ❑ Weather forecast from local news station (3)
- ❑ The National Weather Service (6)
- ❑ Other (4) _____
- ❑ I don't use climate and weather information for business purposes. (5)

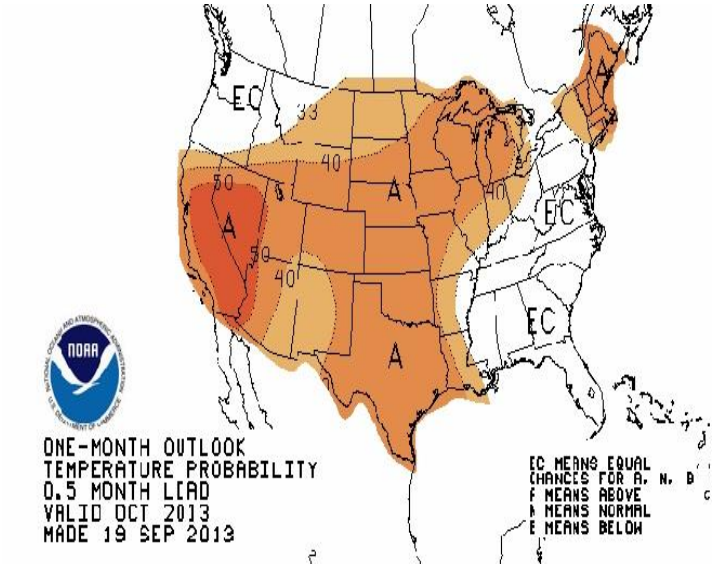
Q5 The government, media and private forecasters give weather and climate forecasts at different time scales: hourly, daily, weekly, monthly and seasonally. Also, other forecasts (e.g. farmers almanac) or environmental signs are used to predict the weather and climate. Please indicate whether you use any of these forecast types to make financially beneficial decisions for your company.

❑ Hourly (1)

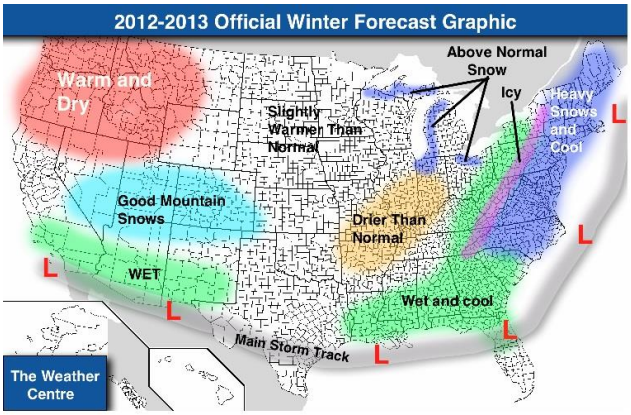
❑ Daily (2)

- ❑ Weekly (3)

- ❑ Monthly (4)



- ❑ Seasonal (5)



- ❑ Other climate and weather forecasts or environmental signs, please explain (6) _____
- ❑ I don't use any of these climate and weather forecasts (7)

Q6 Please explain why hourly forecasts are not used for your business' operations.

- ❑ Did not know they were available (1)
- ❑ Too technical (2)
- ❑ Not important for business activities (3)
- ❑ Other (4) _____

Q7 You indicated that you DO use hourly forecasts. Please select how this forecast is used for your business' operations.

- ❑ Operational Decision-making, such as staffing (1)
- ❑ Risk Assessment, such as staff and customer safety (2)
- ❑ Marketing, such as promoting attractive or appealing climate (3)
- ❑ Investment Decisions, such as buying new property or equipment (4)
- ❑ Sustainability practices, such as energy conservation (5)
- ❑ Landscaping, such as deciding what types of vegetation to plant around your business (6)
- ❑ Finance and Budgeting, such as predicting profit returns or cash flow (7)
- ❑ Other (8) _____

Q8 With 1 being least valuable, how valuable is an hourly forecast when making financially beneficial decisions within your company?

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Q10 Please explain why daily forecasts are not used for your business' operations.

- ❑ Did not know they were available (1)
- ❑ Too technical (2)
- ❑ Not important for business activities (3)
- ❑ Other (5) _____

Q11 You indicated that you DO use daily forecasts. Please select how this forecast is used for your business' operations.

- ❑ Operational Decision-making, such as staffing (1)
- ❑ Risk Assessment, such as staff and customer safety (2)
- ❑ Marketing, such as promoting attractive or appealing climate (3)
- ❑ Investment Decisions, such as buying new property or equipment (4)
- ❑ Sustainability Practices, such as energy conservation (5)
- ❑ Landscaping, such as deciding for which species of vegetation to plant around your business (6)
- ❑ Finance and Budgeting, such as predicting profit returns or cash flow (7)
- ❑ Other (8) _____

Q12 With 1 being least valuable, how valuable is a daily forecast when making financially beneficial decisions within your company?

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Q14 Please explain why weekly forecasts are not used for your business' operations.

- ❑ Did not know they were available (1)
- ❑ Too technical (2)
- ❑ Not important for business activities (3)
- ❑ Other (4) _____

Q15 You indicated that you DO use weekly forecasts. Please select how this forecast is used for your business' operations.

- ❑ Operational Decision-making, such as staffing (1)
- ❑ Risk Assessment, such as staff and customer safety (2)
- ❑ Marketing, such as promoting attractive or appealing climate (3)
- ❑ Investment Decisions, such as buying new property or equipment (4)
- ❑ Sustainability Practices, such as energy conservation (5)
- ❑ Landscaping, such as deciding for which species of vegetation to plant around your business (6)
- ❑ Finance and Budgeting, such as predicting profit returns or cash flow (7)
- ❑ Other (8) _____

Q16 With 1 being least valuable, how valuable is a weekly forecast when making financially beneficial decisions.

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Q18 Please explain why monthly forecasts are not used for your business' operations.

- ❑ Did not know they were available (1)
- ❑ Too technical (2)
- ❑ Not important for business activities (3)
- ❑ Other (4) _____

Q19 You indicated that you DO use monthly forecasts. Please select how this forecast is used for your business' operations.

- ❑ Operational Decision-making, such as staffing (1)
- ❑ Risk Assessment, such as staff and customer safety (2)
- ❑ Marketing, such as promoting attractive or appealing climate (3)
- ❑ Investment Decisions, such as buying new property or equipment (4)
- ❑ Sustainability Practices, such as energy conservation (5)
- ❑ Landscaping, such as deciding for which species of vegetation to plant around your business (6)
- ❑ Finance and Budgeting, such as predicting profit returns or cash flow (7)
- ❑ Other (8) _____

Q20 With 1 being least valuable, how valuable is a monthly forecast when making financially beneficial decisions?

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Q22 Please explain why seasonal forecasts are not used for your business' operations.

- ❑ Did not know they were available (1)
- ❑ Too technical (2)
- ❑ Not important for business activities (3)
- ❑ Other (4) _____

Q23 You indicated that you DO use seasonal forecasts. Please select how this forecast is used for your business' operations.

- ❑ Operational Decision-making, such as staffing (1)
- ❑ Risk Assessment, such as staff and customer safety (2)
- ❑ Marketing, such as promoting attractive or appealing climate (3)
- ❑ Investment Decisions, such as buying new property or equipment (4)
- ❑ Sustainability Practices, such as energy conservation (5)
- ❑ Landscaping, such as deciding for which species of vegetation to plant around your business (6)
- ❑ Finance and Budgeting, such as predicting profit returns or cash flow (7)
- ❑ Other (8) _____

Q24 With 1 being least valuable, how valuable is a seasonal forecast when making financially beneficial decisions within your company?

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Q30 You indicated that you DO use other forecasts or environmental signs. Please select how this forecast is used for your business' operations.

- ❑ Operational Decision-making, such as staffing (1)
- ❑ Risk Assessment, such as staff and customer safety (2)
- ❑ Marketing, such as promoting attractive or appealing climate (3)
- ❑ Investment Decisions, such as buying new property or equipment (4)
- ❑ Sustainability Practices, such as energy conservation (5)
- ❑ Landscaping, such as deciding for which species of vegetation to plant around your business (6)
- ❑ Finance and Budgeting, such as predicting profit returns or cash flow (7)
- ❑ Other (9) _____

Q31 With 1 being least valuable, how valuable other forecasts or environmental signs are when making financially beneficial decisions within your company?

- ❍ 1 (1)
- ❍ 2 (2)
- ❍ 3 (3)
- ❍ 4 (4)
- ❍ 5 (5)

Q33 Thinking about how each forecast can help you make financially beneficial decisions for your company, please compare the value of each forecast type with 1 being the least valuable.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)
Hourly (1)	❍	❍	❍	❍	❍
Daily (2)	❍	❍	❍	❍	❍
Weekly (3)	❍	❍	❍	❍	❍
Monthly (4)	❍	❍	❍	❍	❍
Seasonal (5)	❍	❍	❍	❍	❍
Other Forecasts (6)	❍	❍	❍	❍	❍

Q27 Please indicate your highest level of completed education.

- ❍ Less than high school (1)
- ❍ High School or General Equivalency Diploma (GED) (2)
- ❍ 2-year college/ Technical school (3)
- ❍ Some College but no degree (4)
- ❍ 4-year college (5)
- ❍ Post graduate (6)

Q28 How many people are employed in your company?

Q19 Is there anything else you would like to say about forecast use in your business or about certain types of forecasts in particular?

- ❍ Yes (1) _____
- ❍ No (2)